Vol. XVIII, No. 3 APRIL, 1947

OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

Today's Standardization Trends . . . . . *by W. B. Peirce*

The What and How of Radio Frequency Heating . . . *by Bennett E. Rector*

Kennamilling . . . . . *by H. A. Frommelt*

The Role of Standards in the System of Free Enterprise . . . . . *by Howard Coonley and P. G. Agnew*

Precision Lapping by the Centerless Method . . . . *by Peter L. Sommer, Jr.*

Report on Plastic Automobiles . . . . . *by Thomas A. Dickinson*

Drawing Die Problems and Formulae . . . . . *by James Walker*

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A.S.T.E. News • Andygrams • Gadgets • Fundamentals of Tool Engineering • Good Reading • Bulletins • Tools of Today • North, East, West, South in Industry • Index to Advertisers

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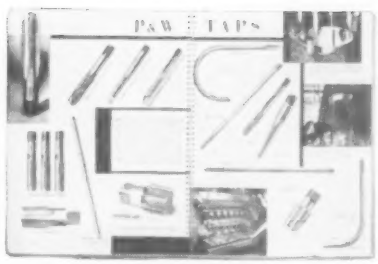

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THE TOOL ENGINEER

AMERICAN SOCIETY OF TOOL ENGINEERS

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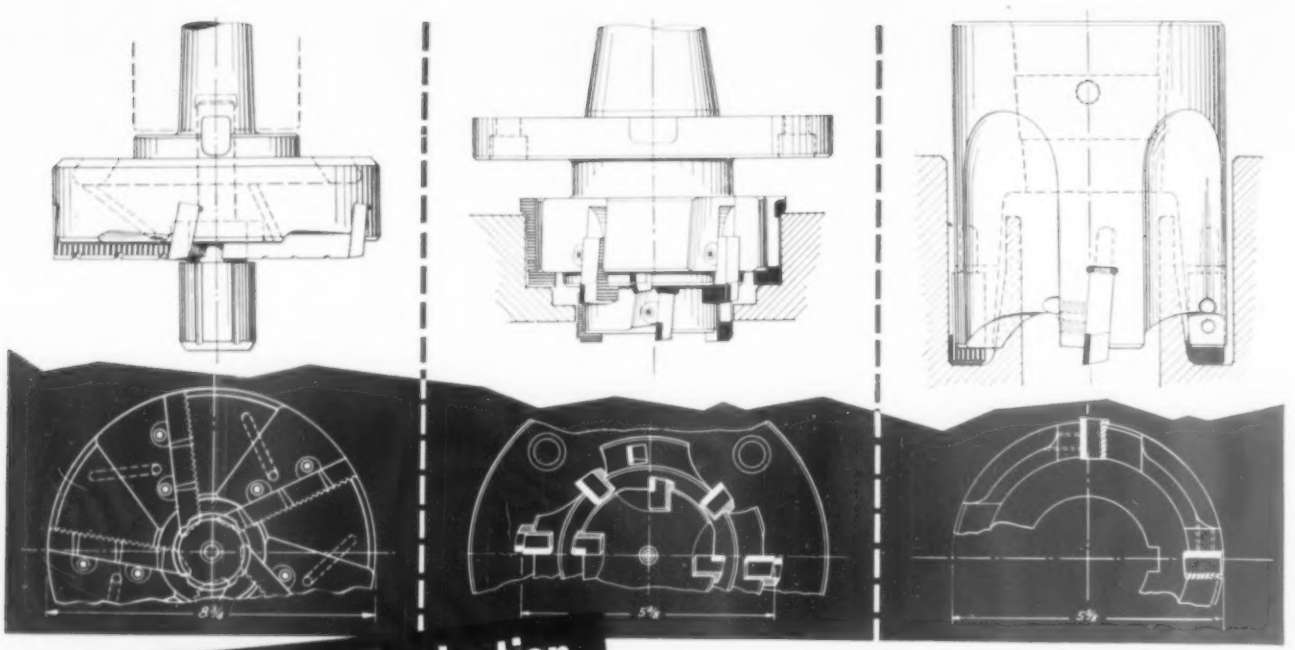

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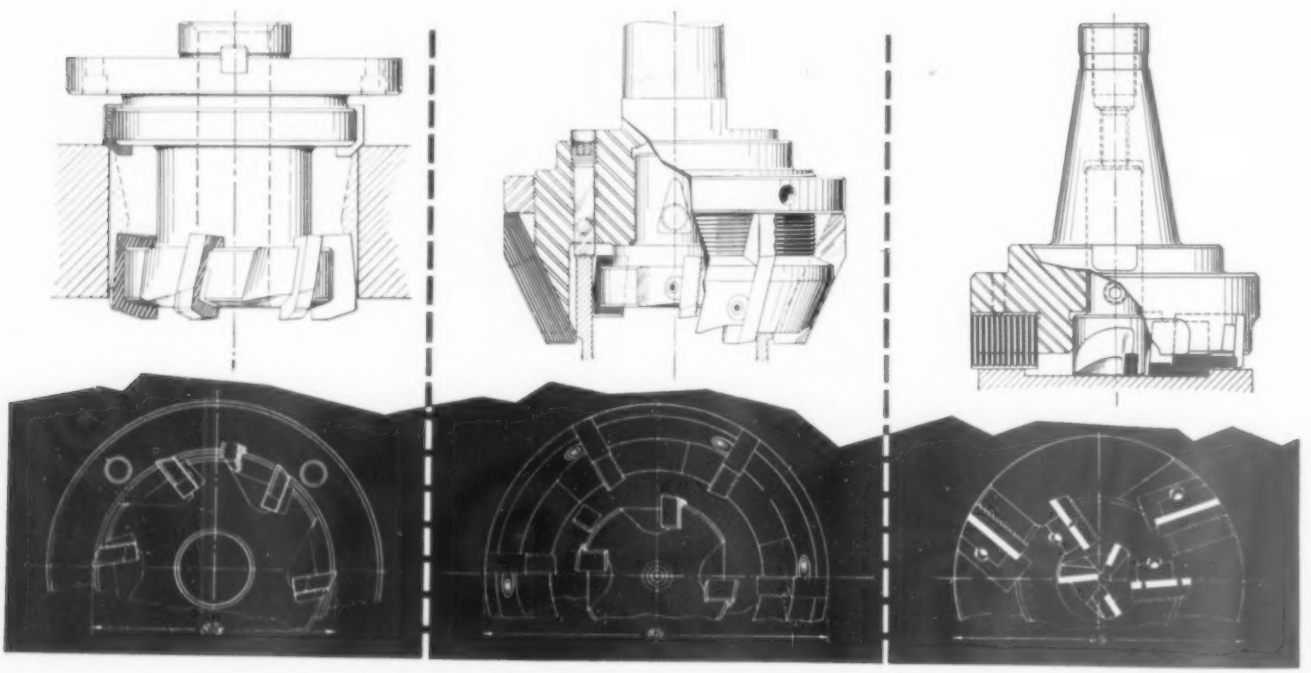

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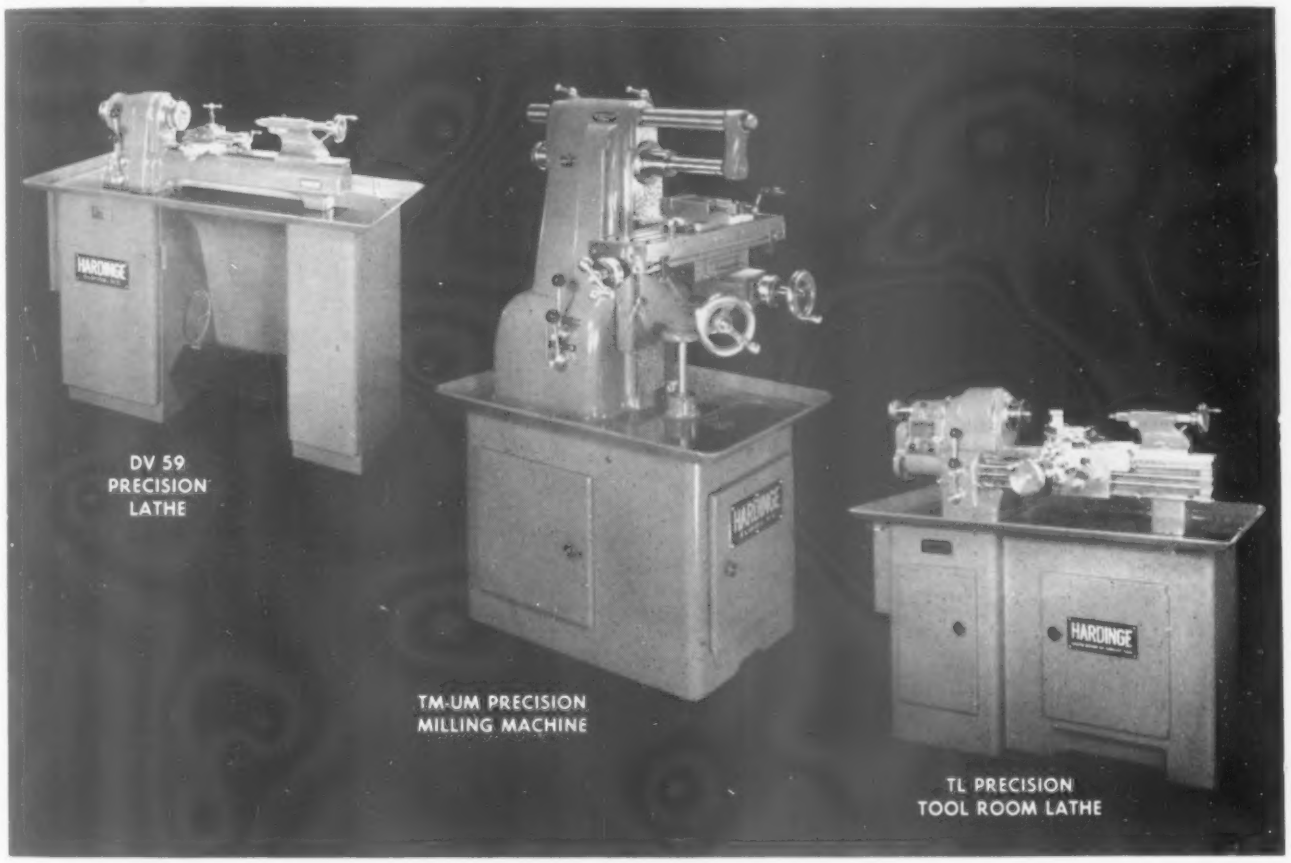

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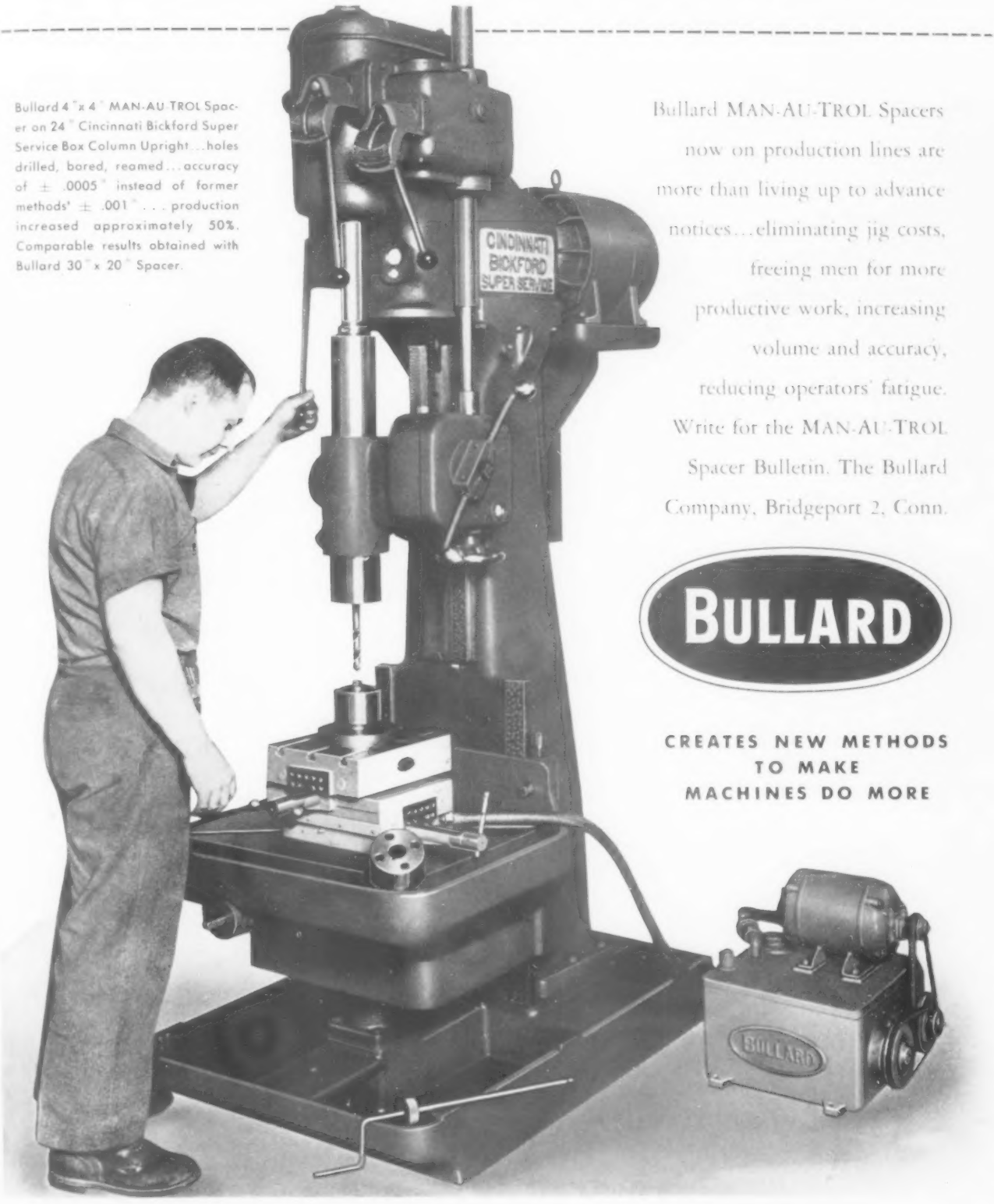

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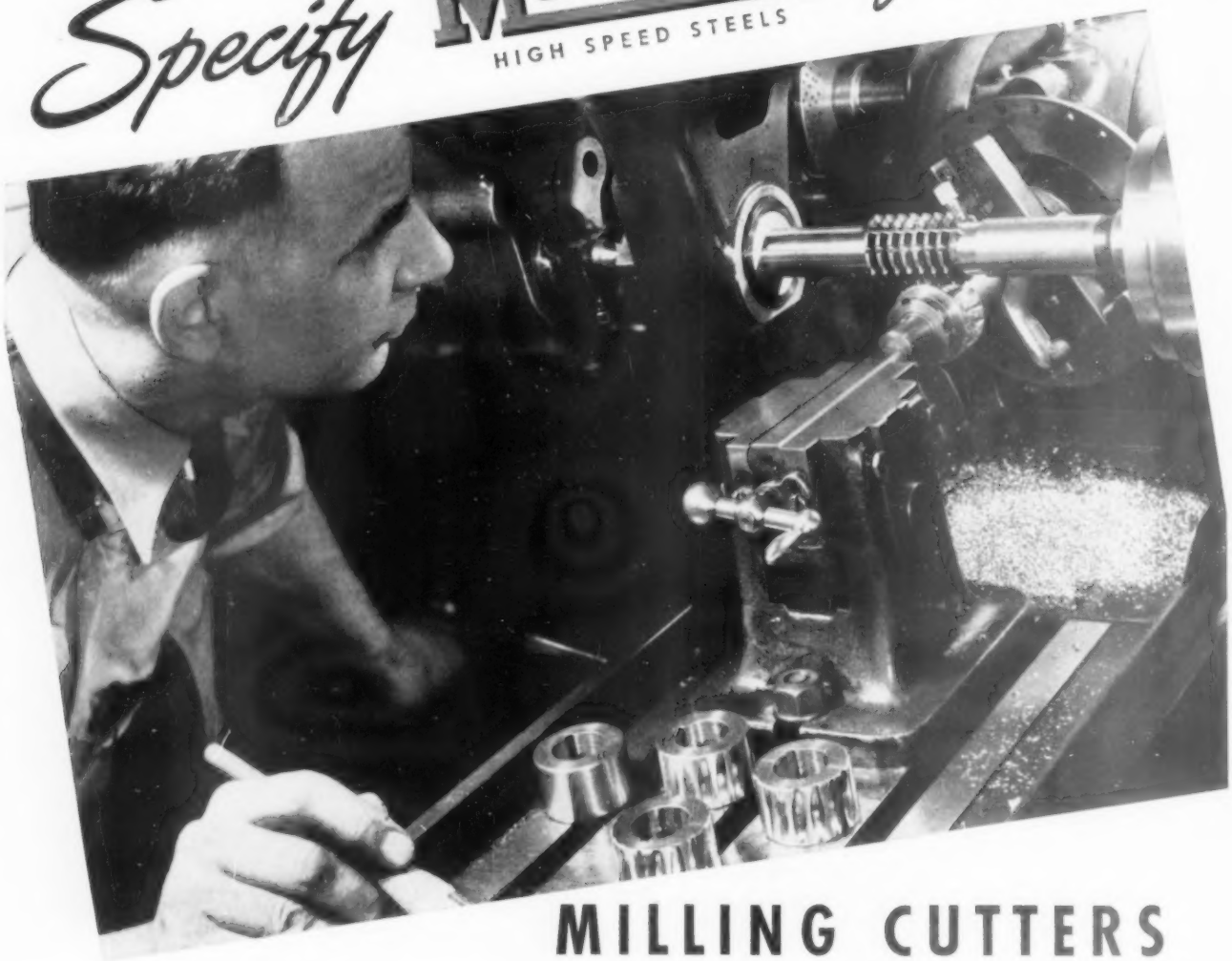

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"HI-MO"	Firth-Sterling Steel Company
"REX T-MO"	Halcomb Steel Company
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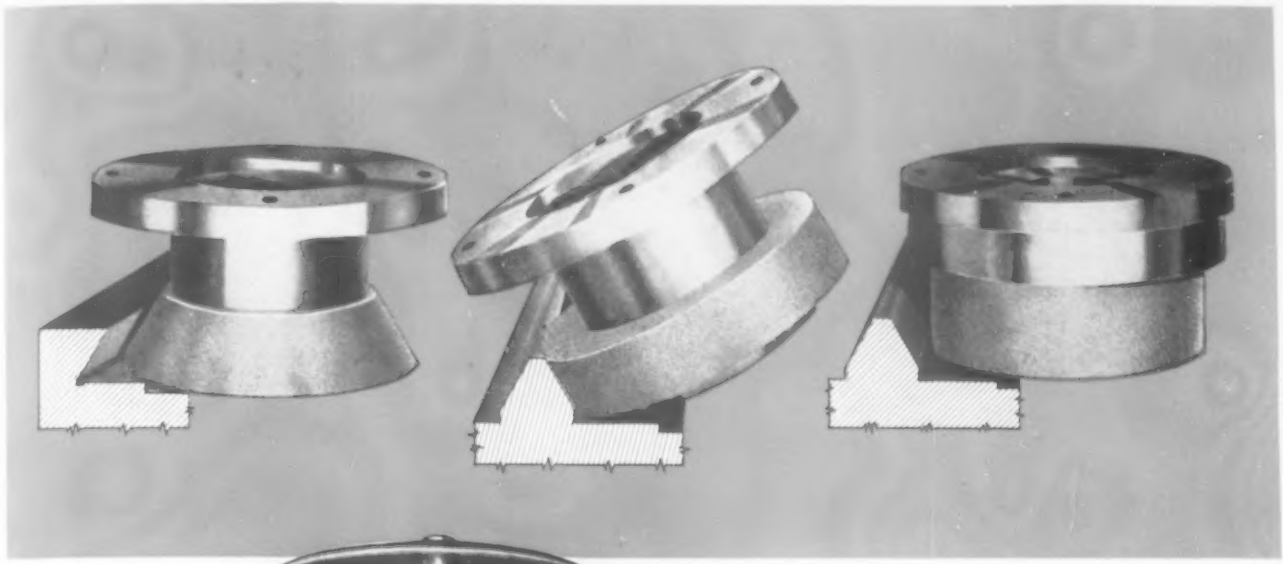

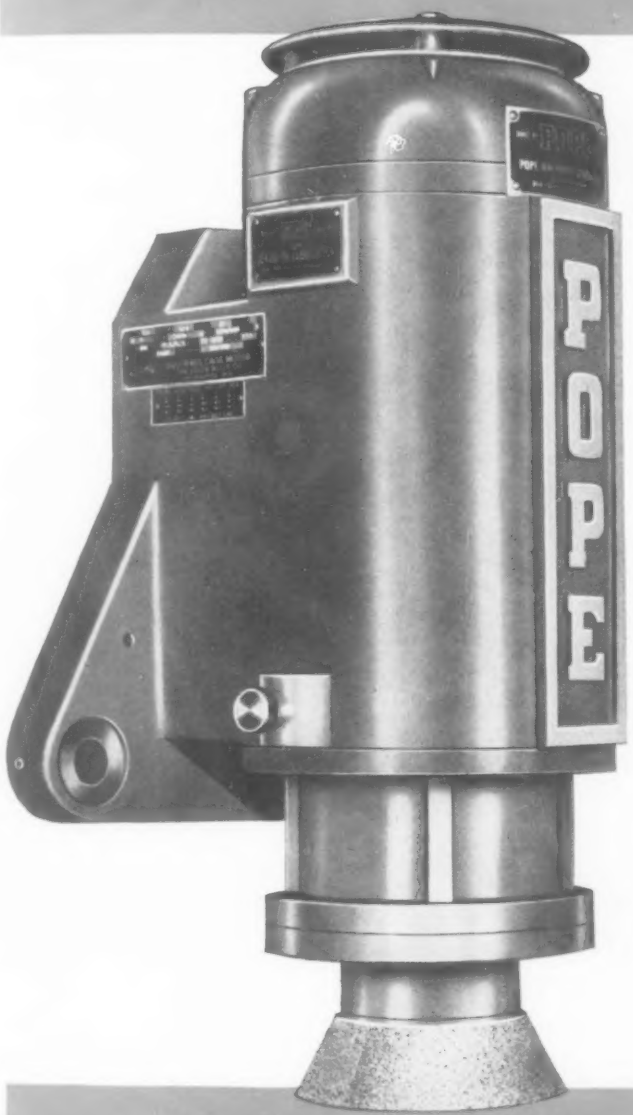

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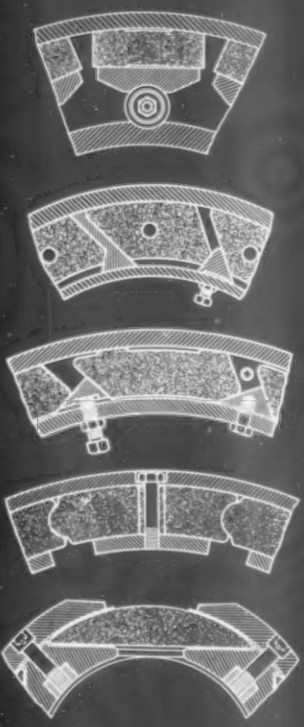

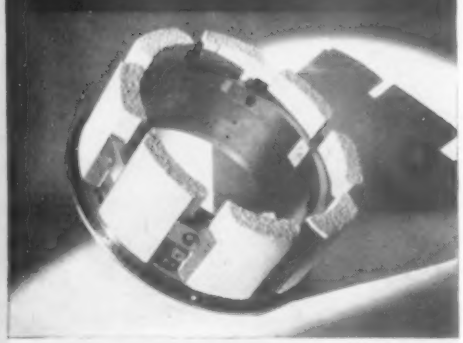

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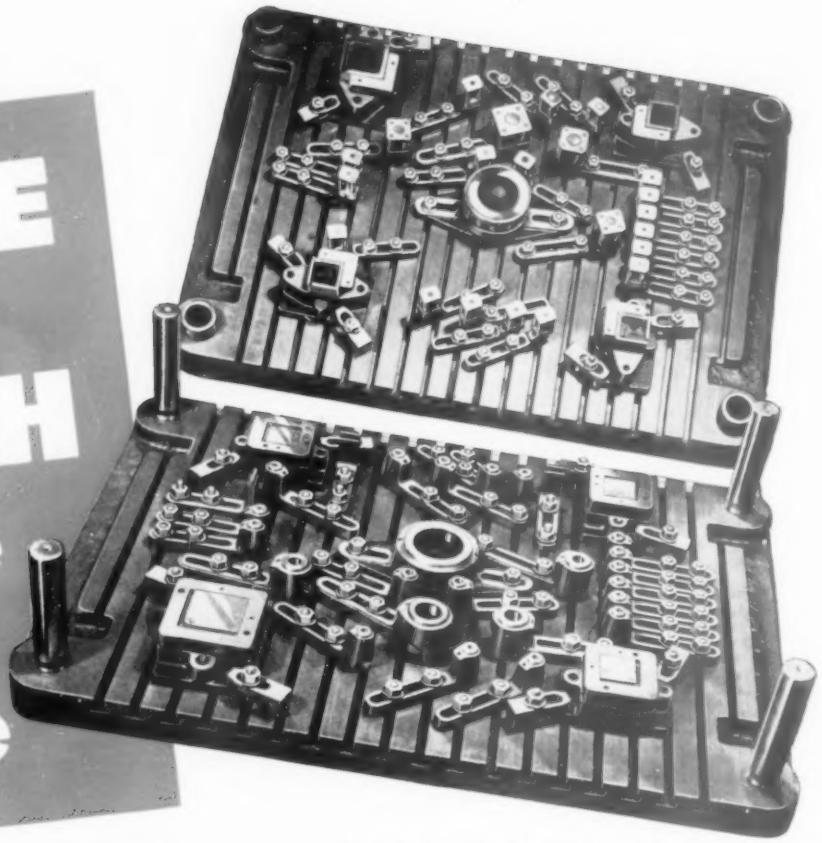

A typical set-up for notching and piercing.

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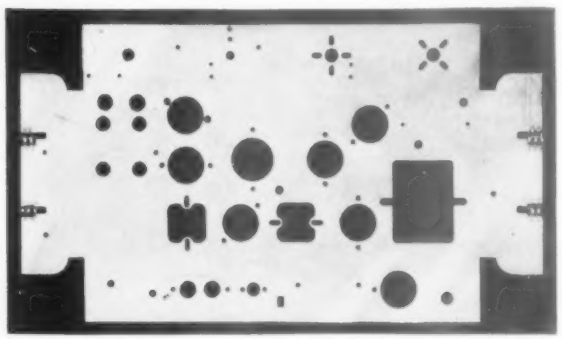
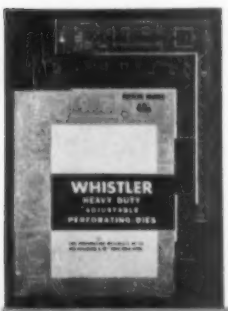


Pierced and notched with Whistler multi-use adjustable dies.

You save press time and speed production by combining corner notching dies and group dies in the same set-up with adjustable piercing dies. Press operations are reduced to a minimum. Engineering changes effecting relocation or sizes of holes can be made without delay right on the press.



Whistler multi-use adjustable dies are available from stock . . . a day or two from your plant . . . in all standard sizes from 1/32" to 3" diameters . . . round, square, ovals and rectangles. Notching and group dies to order. In addition to mighty attractive savings in original die costs there is this important advantage of eliminating weeks of production delay.

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« Today's Standardization Trends »

RAPID AND PROGRESSIVE strides have been made in industrial standardization during the last two decades despite the dearth of information on the policies of standards groups and, in some cases, a lack of understanding of the over-all objectives of standards planning. But, if advancements in this field are to continue at the accelerated pace necessary to meet the social, economic and technical demands of both a more social conscious industry and an expanding economy, greater efforts in proper education and information must be made.

Certain segments of industry and management . . . and even of the public at large . . . must be brought closer to a realization of the benefits and trends of industry-organized standards. Industry's self-imposed and self-regulated limitations on standardization should be made well known. It is imperative that the deterring influences serving now to impede its progress be made clearly understood.

Today, one of the most important trends in standardization is its movement from government domination and toward operation on a voluntary basis by industry. With the American Standards Association, industry's own agent, at the helm, the United States Bureau of Standards will remain in the field to perform only certain specialized standards functions. These will be concerned mainly with basic research.

The domination of standardization by independent enterprise should have a streamlining effect on standards in general. Since standards activities entail the pooling of myriad types of specialized knowledge plus skills developed only through practical experience, industry itself is the only place to which the agency for standardization can turn for the assistance and guidance of able specialists. Now that industry is setting its own standards, these specialists will be more readily available. They should also lend more active support to all phases of standardization.

Of significance, also, is the growing recognition by industry that standards engineers must occupy a more important place among its technicians. For much too long they have been tolerated, but not given the proper degree of respect. While work in standardization is accorded recognition in most engineering circles, it seems to be the opinion of some in high places that the benefits derived from standards are highly intangible. Others argue that results from engineering in the field of standardization are usually evidenced a long ways in the future and, therefore, are not as important as the current work of designing new products and getting them into production.

These attitudes must be corrected. The fact that industry is now largely responsible for its own standardization programs will, no doubt, have a desirable effect on this type of thinking. But efforts must be made by engineers in specialized fields such as tool engineering, and by enlightened operating management to correct these entrenched attitudes.

Well directed programs of information must be instituted to distribute standards information broadly. Standards engineers are already cognizant of the benefits to be derived from their work and, therefore, should not be a major object of any such campaigns. Except for some phases of standardization in which the general public has a large stake, this classification has little or no interest in the subject. Educational efforts, therefore, must be directed principally toward business and engineering executives and that part of operating management which is still unenlightened.

Even though standardization has been of considerable importance to nearly all types of manufacturing and servicing for the past twenty years, it is still necessary to impress those who are in position to do most for advancements in this field that standards activities are not designed to make products uniform or to deter design differences. They are set up to effect manufacturing economies that could not otherwise be accomplished. These benefits are passed on to the ultimate consumers which results generally in higher standards of living.

Well informed industrialists have come to realize that without standards a minimum of versatility results . . . and where versatility doesn't exist, only a minimum amount of industry can survive.

In order to enjoy to the fullest all of the benefits of mass production, everyone in industry who would like to broaden his markets and see higher living standards everywhere should get behind and cooperate with industry-organized standardization.

President 1947-48

By B. E. Rector

The What and How of Radio Frequency Heating

In Which the Author Explains, in Layman's Language, Basic Principles of Induction and Dielectric Heating

FROM LIMITED USE a few years ago, radio frequency heating has now spread to many fields of industry, such as plastics, rubber, wood, food, textile, and paper. In the field of metal working, it is used for soldering, brazing, annealing and hardening. The variety of applications and the number of installations are growing steadily, and will increase still more rapidly as men in various industries come to realize its possibilities and become more familiar with its basic principles.

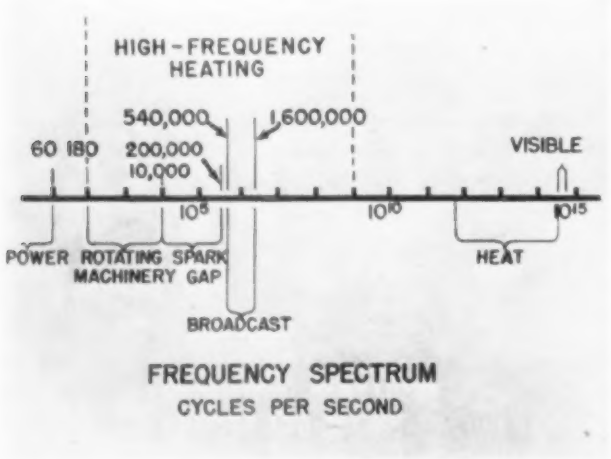
Bennett E. Rector, **Electronics Engineer in the Industry Engineering Department, Westinghouse Electric Corporation, was born in Shawnee, Tennessee, and received a Bachelor of Science degree in electrical engineering from the University of Kentucky in 1939.**

Before joining Westinghouse, he served as power engineer for a utilities company, then entered the Industry Engineering Dep't at the East Pittsburgh Works, where he has specialized in the application of high frequency power to industrial processes. He is member of the American Institute of Electrical Engineers and the Institute of Radio Eng'rs.

Frequencies from 200,000 Cycles

According to common usage, radio frequency heating implies the use of alternating currents ranging from 200,000 to hundreds of millions of cycles a second. Or, to use the "shorthand" of the trade, from 200 kilocycles (kc) up to hundreds of megacycles (mc), for one kilocycle equals 1,000 cycles, and one megacycle equals 1,000,000 cycles. The term "high frequency heating" is more loosely used to include not only these frequencies, but also frequencies from 180 to 200,000 cycles. Fig. 1 shows the R-F (radio frequency) heating spectrum.

FIG. 1. Frequency spectrum—Frequencies for R-F heating begin at 200,000 cycles per second; extend well into millions of cycles per second.



R-F Generators

Power for high frequency heating in the 180 to 200,000 cycle range is usually furnished by motor generator frequency changers or spark gap generators. For most radio frequency heating applications, power is supplied by vacuum tube generators. This is the device with which we are concerned here, for it is primarily responsible for most of the revolutionary advances in modern heating technology.

The principle structural elements of radio frequency generators are (1) an electronic rectifier, which takes the incoming a-c power and delivers a suitable high voltage direct current, and (2) oscillator tubes and associated circuit elements which change the direct current to alternating current of the desired radio frequency. In addition, there are coils or electrodes for applying the radio frequency current to the work in such a way as to produce the desired heating effect. There are also various associated control devices.

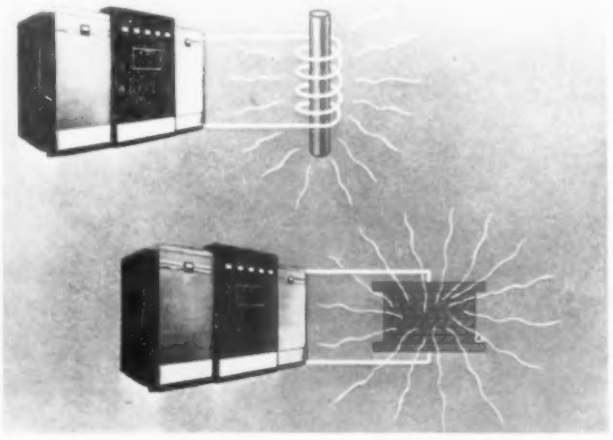
Similar to Radio Transmitter

The generating equipment has essentially the same function as (and bears a close resemblance to) the transmitting unit of a radio broadcasting station. In fact, much of the early experimental work in R-F heating was done with regular broadcasting equipment. Because of the experience thus gained, the actual generation of R-F power for heating has been a lesser problem, and engineers have been able to concentrate on the many new problems involved in the precise heating of workpieces of a wide variety of shapes, sizes and materials.

Two* fundamentally distinct methods of applying R-F power are employed—by *induction*, when the workpiece is

*A third method of application is introduced with the development of microwave power.

FIG. 2. Upper Diagram: R-F energy transmitted through the coil induces a similar current in the rod (workpiece). Heat results from resistance of the workpiece. Lower Diagram: Workpiece is a non-conductor (dielectric) between two electrodes. R-F energy in electrodes sets molecules of workpiece in motion, generating heat.



of a material which is a conductor of electricity, and *dielectrically*, when the workpiece is a non-conductor (dielectric). The two methods are shown diagrammatically in Fig. 2.

Induction Heating

The phenomenon of induction is familiar to everyone who has an elementary knowledge of electricity. We know that when an electric current flows through a conductor, a magnetic field is set up around it, and that if the current is alternating, the magnetic field is constantly changing. We know that if a second conductor is brought within this changing field, a voltage will be induced in this conductor, and a current will be forced to flow in it also.

We know, too, that whenever there is a flow of electricity in a conductor there is also resistance, and that the energy necessary to overcome this resistance appears as heat. These facts were utilized in the induction furnace, which is now an established method of melting metal or heating it for forging. The induction furnace, however, uses comparatively low frequencies, and does not come under the head of R-F heating.

"Skin Effect"

Radio frequency induction heating involves the utilization of still another characteristic of electricity. When we are dealing with direct current, or with low frequency alternating current, the current flow is substantially the same at the center of the conductor as at its surface. As the frequency increases, the current tends to be crowded to the outside of the conductor, so that when we get to a few hundred thousand cycles per second, virtually all of the current crowds to the surface, as shown in Fig. 3.

This phenomenon, known as "skin effect," is a vitally important characteristic of R-F induction heating because it permits sharp concentration of heat at the surface of the workpiece. Further, since the depth to which the current can penetrate is determined in part by the frequency of the applied voltage, we can control this depth very precisely.

The advantage of precise depth control is shown in such applications as shaft hardening, shown in Fig. 4. Here, the bearing surface must be made as hard as possible, but the core of the shaft must remain tough and resilient. The problem is to heat the surface, to a predetermined depth and temperature, so quickly that little heat is transferred to the interior of the shaft.

For the induction heating engineer, this problem is simple. The shaft is properly positioned within the inductor coil of a radio frequency heater, current is passed through it, and the surface metal becomes red hot over the desired area so quickly that the heat has no time to wander off where it might do harm instead of good. When the correct hardening temperature is reached, the power is automatically shut off and the hot surface quenched in water or oil.

Depth Control

Shaft hardening and similar operations can also be performed by passing the shaft through a coil at a uniform rate of speed, such that the time of passage through the coil is just enough to allow the shaft's surface to reach the correct hardening temperature. The piece is automatically quenched by sprays of water from nozzles just below the inductor coil.

Contour-hardening, as in Fig. 5, is another case in which R-F induction heating, with its precise depth control, is of great value. Only the toothed surface is hard—the unheated core still retains the desired toughness and elasticity. Still another application is the hardening of internal bearing surfaces, almost impossible by any other method but extremely easy with R-F induction heating.

Area Control

A second advantage of R-F heating is its precise area control. In the assembly shown in Fig. 6, for example, a cover plate is brazed onto a tube without affecting another brazed joint only a quarter of an inch away. Localized hardening or annealing of small parts is also accomplished easily by induction heating.

"Production Line" Methods

Finally, induction heating lends itself readily to the "production line" method of manufacture. There are many appli-

FIG. 3. Low frequency current is distributed evenly throughout conducting material, but high frequency current crowds to the outer surface of the material.

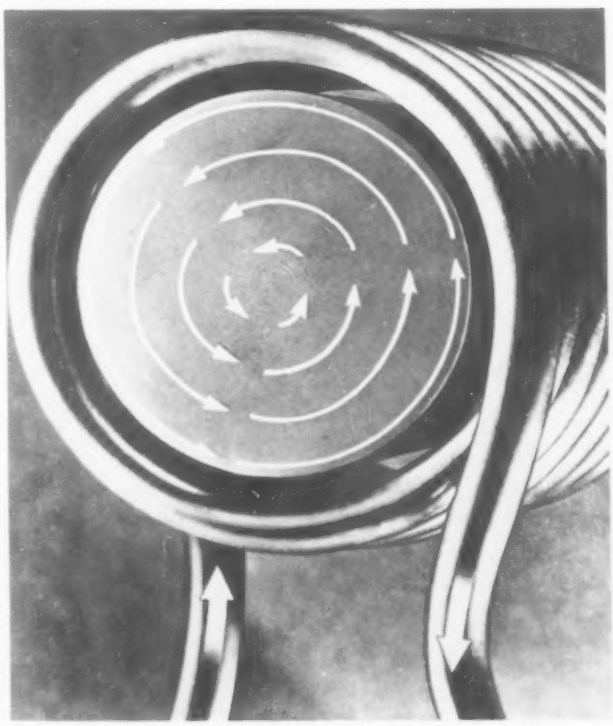


FIG. 4. In shaft hardening, the shaft is passed through the work coil at a predetermined speed. At the right instant, the power is automatically shut off and the shaft drops into the quench.

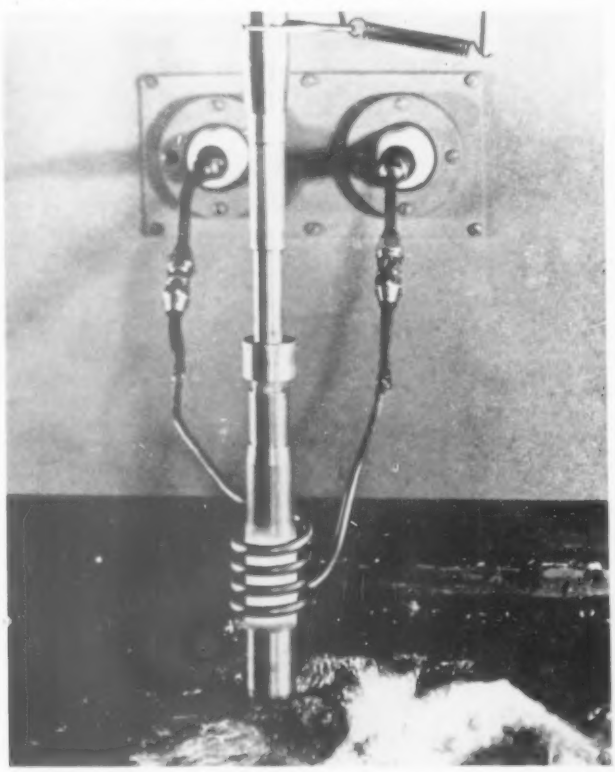


FIG. 5. Hack saw blades, mounted as shown, are carried on a conveyor belt so that teeth pass through the work coil. Hardening becomes a "production line" process; the operator's only task is to put the blades in place and to remove them.

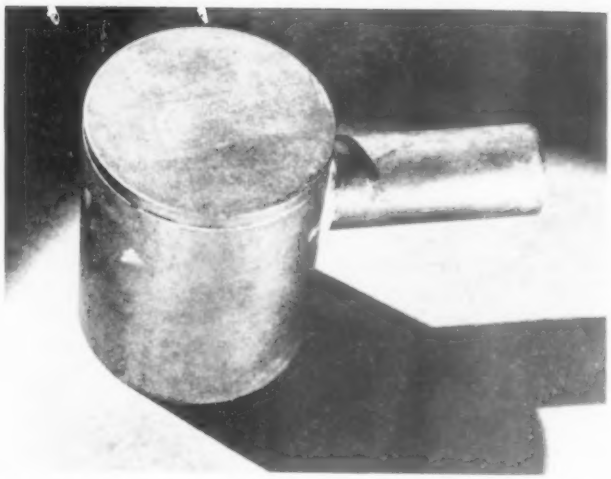


FIG. 6. Brazing the cover plate on this tube by conventional methods would have damaged the joint at the right. Induction heating accomplished it without difficulty, and in considerably less time.

cations, like the brazing operation in Fig. 7, in which parts to be heated can be carried through the inductor coils on conveyor belts or other feeding devices. Control of time and temperature is automatic, so that relatively unskilled labor can be taught to do various jobs better and more rapidly than when done by highly skilled men under former methods.

Dielectric Heating

Dielectric heating, which got off to a slower start, is now running a close second to induction heating in the radio frequency field. Though the generating equipment for this type of heating is essentially the same as for induction heating, it poses some more difficult problems. We are no longer dealing with frequencies of several hundred thousand cycles a second, but with millions of cycles. Before the war, such frequencies would have been out of the question for industrial use, but the accelerated pace of wartime developments in short wave radio makes them practicable today.

The method of applying this very high frequency power is based on the principle of the condenser or, more properly, the capacitor. Broadly speaking, any pair of conductors separated by an insulating material constitute a capacitor. In dielectric heating, the conductors are a pair of metal plates, called electrodes, and the piece to be heated (which must be a material which is normally an insulator) is placed between them.

In radio and power work, capacitors have a number of functions, but the function of this capacitor is based on a characteristic which is definitely undesirable in other applications. That characteristic is the tendency of the insulating substance—or dielectric—to become hot when an alternating electric potential is applied to the electrodes.

Here, figuratively speaking, is what happens in a microscopically small section of the material being heated when a rapidly alternating voltage is applied to the electrodes. Because of the electrical charges within the molecules, the rapid changes of polarity on the electrodes tend to make the molecules vibrate. The more rapid the reversal—that is, the greater the frequency—the more rapid the vibration. This molecular motion produces heat.

One noteworthy characteristic of dielectric heating is the uniformity of molecular agitation throughout the dielectric. Molecules in the middle of the workpiece are shaken back and forth by the alternating field just as hard and just as fast as they are anywhere else. Hence, there is no overheating at the surface and no underheating at the center.

The amount of heat procured by this molecular vibration is proportional to the *frequency*, which determines the number of vibrations per unit of time; also, to the square of the applied voltage, since this voltage determines the amplitude of the vibrations, and to the "loss factor," which is a way of expressing the fact that different materials have naturally different rates of heating.

FIG. 7. These pieces are automatically brazed, on an assembly-line basis, as a conveyor belt carries them through the work coil.

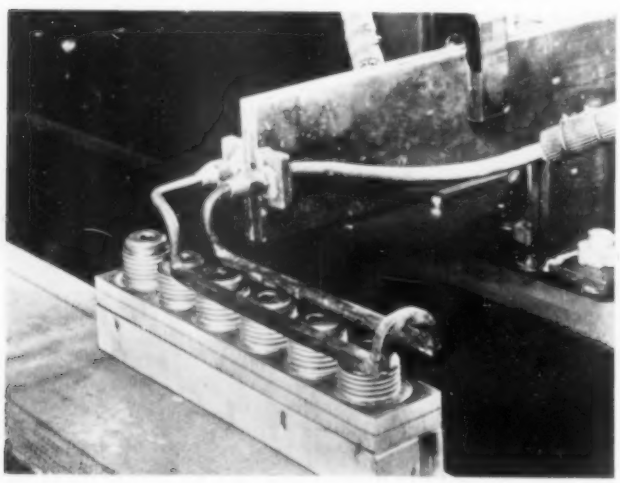


FIG. 8. Dielectric heating of preforms has cut time and cost of molded plastics and has improved the quality of the product.

The speed, convenience, and uniformity of dielectric heating have led to its use in such applications as the preheating of plastic preforms before molding (as in Fig. 8) where it has resulted in reducing molding time, improving the finished product, and cutting mold costs.

Manufacture of Plywood

The marvelous new plywoods we hear so much about are made possible by synthetic binders. These, however, are thermo-setting, which means that they must be heated after application. When older methods of curing by means of steam heated platens were used, the thickest plywood that could economically be made with these binders was about one inch. With dielectric heating, however, thickness doesn't matter since heat is generated within the material itself and does not have to seep in from the surface. Consequently, plywoods can now be made with phenolic resin adhesive comprising as many as 148 layers of birch veneer and measuring over a foot thick. Multi-layer plywoods cured dielectrically have demonstrated a tensile strength of 15,000 pounds per square inch, yet, are only half the weight of aluminum. A press for bonding plywood is shown in Fig. 9.

In Regular Production

Other applications in which dielectric heating has demonstrated its value are textile drying and twist setting, the curing and drying of rubber, bonding of laminated plastics and wood, thawing of frozen foods—and the list is still growing.

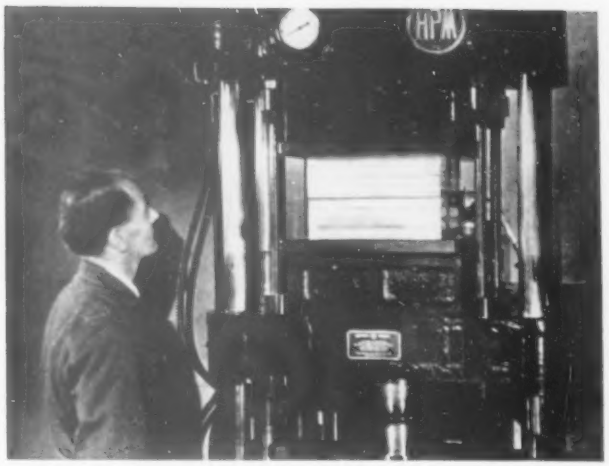


FIG. 9. Extremely thick blocks of plywood can be glued together in a few minutes. Plates of the press serve as electrodes in this dielectric heating application.

It should be noted that none of these applications of dielectric and induction heating are "experimental." Radio frequency heating has passed out of the laboratory stage and has established itself in regular industrial production. Equipment, now in use, totals many thousands of kilowatts and faithfully performs a wide variety of industrial heating jobs week after week, month after month, year after year.

By Gunnar Skog

New Carbide Development Has Wide Application

A NEW DEVELOPMENT, of major interest to industry in that it tremendously expands the application of carbides, is announced by Carboloy, Inc., Detroit. This development makes it possible to attach or mount carbide parts or segments with screws, in much the same manner that parts made of softer materials may be located with dowels and attached with screws.

Heretofore, such application has been impractical, if not actually impossible because, in the hardened state, carbides are unmachineable to all practical purposes. They cannot be drilled or tapped, or otherwise machined except by grinding. This objection has now been overcome, in the Carboloy development, by a process in which machineable materials are solidly imbedded, in the carbide parts, wherever the part is to be drilled and reamed for dowels, or tapped for screws.

Of particular interest is the fact that holes may be tapped blind, on the attaching side of the parts. Thus, large wear strips may be solidly bolted down and yet present an unbroken wear surface without any "through" holes. Of further

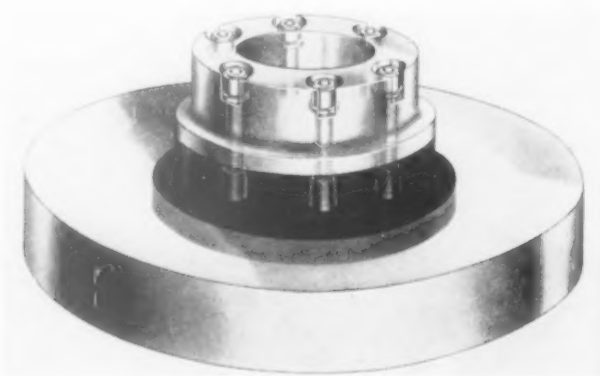


FIG. 1. Sectional carbide dies, as shown at left, may be easily and quickly assembled by the new Carboloy attachment method. This deep drawing die is assembled from four sections of Carboloy cemented carbide and shows some of the attachment points. The carbide portion is over 12" long. *FIG. 2,* BELOW, shows a Carboloy lined ceramic mold. In such products, the new method may considerably reduce the cost of complete assemblies.

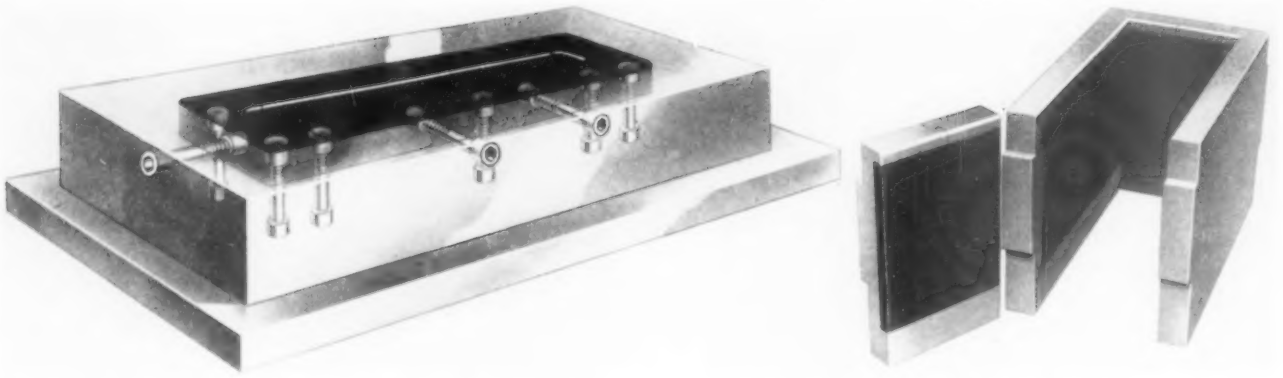


FIG. 3. At LEFT, a 5-stage Carboloy progressive lamination die. The female members for the first and third stages are attached to the steel die block, using the new Carboloy mechanical attachment method. The points of attachment are indicated by lighter toned spots above the stud locations. All working parts of this die set are of Carboloy cemented carbide, including dies, punches, locating and guide pins. At RIGHT is shown a Carboloy punch and die set for blanking and forming. The points of attachment, by means of studs and nuts, are shown in phantom.

interest is the fact that carbide insets may be imbedded in softer materials which may then be contour machined, if so desired, on lathes or millers equipped with profiling attachments.

Since, however, the softer materials must be molded in with the powder metal, the method implies a factory job. Hence, the parts so made must be "pre-engineered"—that is, the location of nut blanks (for later drilling and tapping) and other insets must be approximately pre-determined. The parts may then be drilled and tapped at the Carboloy plant or, if so preferred, by the user "on the job."

Typical examples of applications are shown in the several illustrations. Fig. 1 shows a 5-stage progressive lamination die, in which the female members of the 1st, 2nd and 3rd stages are attached to the steel die shoe by means of the new method. The points of attachment are indicated by lighter toned spots above the stud locations. The large carbide punch for the 1st stage, and the two punches for the 3rd stage are also attached by this method. The "modernness" of the development is clearly indicated by the "Anti-Friction" die set.*

Fig. 2 shows a punch and die set for blanking and forming. The punch, shown entered into the die, has a steel backing, and soft steel insets are shown in the phantom along with attaching screws. The carbide punch is shown in black, as is the circular carbide die, which in turn is inset into the die shoe.

In Fig. 3, at left, is shown a sectional carbide deep drawing die, assembled from four sections of Carboloy cemented carbide. The carbide portion is over 12" long, and all four sections are not only drawn solidly against the steel shoe, but solidly against the sides, as well, by the screws (shown in phantom) engaging the threaded insets.

At the right, in Fig. 3, is shown a carbide lined ceramic mold, the size of which is indicated by the fact that the over-all dimension, from extreme left hand edge of the cover to the extreme right hand edge of the box, approximates 13". The photograph clearly illustrates how the Carboloy insets are molded into the softer backing which, in turn, may be machined, drilled or tapped as desired.

While new, from the standpoint of recent announcement, the method has been in actual manufacturing use for some time in a variety of applications on both small and large parts. It has been proven entirely practical and portends an almost unlimited scope of application. For example, the method lends itself to compound, progressive and segmented dies, and particularly to blanking dies with which the use of carbides has effected amazing economies. It will also serve admirably for wear parts in fixtures and machines, cams, guides and so on *ad infinitum* through the gamut of applications where long life and freedom from wear is demanded.

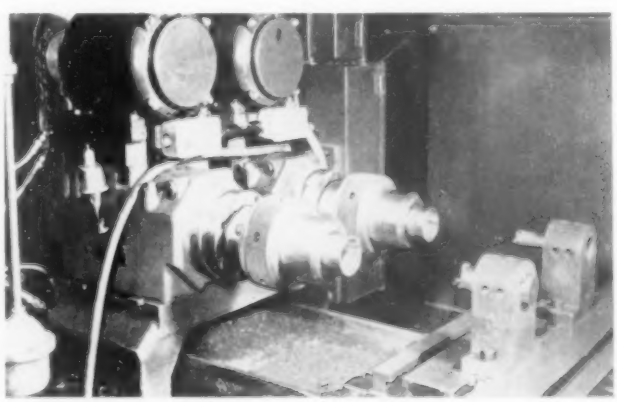
*Anti-Friction Die Sets, by Industrial Division, Lempco Products, Inc., Dunham Rd., Bedford, Ohio. Shown in "Tools of Today" Department, May '46 *The Tool Engineer*.

Advanced Tooling Promotes Efficiency and Enhances Accuracy

AS AN EXAMPLE of the increased efficiency that is usually attained through use of advanced tooling, a bushing was required to be bored 2.000" (+ .001"/—.000") one end, then reversed and bored 1.875" (+/—.0005") the opposite end. The bores were required to be concentric. As originally set up on a precision boring machine, considerable eccentricity resulted due to variations in the O.D. of the bushings.

Also, the use of hand-operated chucks led to variations in the I.D. because of varying pressures applied by different operators. Scrap ran high—about 13%—and operator fatigue was excessive. The original chucks were then replaced with Erickson No. 701 air-operated face plate chucks, and the change resulted in an immediate and marked improvement.

Concentricity between the individual opposed bores was held within plus or minus .002", and concentricity between bores and O.D. within .0005". In addition, finish was greatly enhanced and operator fatigue practically eliminated. The end result was that production increased 50% and scrap dropped from 13% to 1%. These air-operated chucks, made by Erickson Tools Div'n, 2309 Hamilton Ave., Cleveland 14, are typical of the Erickson line of chucks, shown at various times in the "Tools of Today" department, *The Tool Engineer*.



By H. A. Frommelt

Kennamilling

An Analysis of Unusual Economies Effected by Cemented Hard Carbides, and an Interesting Review of Milling Fundamentals

KENNAMILLING, the subject of our present discussion, is the combination of a carbide and a technique which have been joined to produce a superior milling technique.

Mr. Philip McKenna, President of Kennametal, Inc., has presented to you the story of cemented hard carbides as cutting materials and their application to the various problems of metal removal and processing.*

Dr. H. A. Frommelt. **Director of Research at Kennametal, Inc., Latrobe, Pa., was formerly professor and head of Mechanical Engineering at Marquette University. He also served as Sup't of Apprentices at Falk Corp'n, Milwaukee; and, during the war, he inaugurated the Milwaukee District War Training Program. During that time, he was also associated with Kearney & Trecker as Director of Sales Promotion, later as Director of Industrial Research.**

This article will concern itself specifically with the technique of milling as resulting from the union of a carbide, suited to metal removal according to the milling process, and a technique involving a suitable tool holder.

Fig. 1 presents the line of standard Kennamills, the result of this technique, ranging from 4" to 12" in diameter. Fig. 2 presents a closeup of the cutter which indicates that the solid carbide blades are mechanically held by means of suitable wedges. The solid carbide blades are set at a 15° positive angle to the radius, and this angle is maintained at all times regardless of the application of the cutter to various materials.

This 15° radial rake angle is not, however, suited for the harder materials such as steel—particularly the heat treated alloy steels. This strong, positive angle would quickly result in a breakdown of the cutting edge. Hence, for materials whose Brinnel hardness is above 150, a 7° negative angle is ground into the edge of the solid carbide blade as shown in Fig. 3. The width of this cutting land need only be, theoretically, as wide as the chip is thick. This is obvious since only that portion of the carbide blade comes in contact with the workpiece which removes an amount of metal equal to the chip thickness.

As noted previously, these solid carbide blades are held mechanically by means of wedges as shown in Fig. 4; hence, a wedging angle of 7° is a part of the specification of both the wedge and the blade. This wedging angle is a negative angle and becomes the 7° negative axial rake angle common to this type of cutter, regardless of the material to be milled. This 7° negative axial rake angle is used for cast iron, steel and its alloys, in both the treated and untreated forms, and also the non-ferrous materials such as aluminum, magnesium and the plastic materials.

The nature of the cutting land is clearly shown in Fig. 5. Its width is approximately standardized at .030". In the illustration presented here the cutting land is set at a 7° negative angle to the radius and hence this specification of angle would be used for steel.

All of the angles as used for steel are clearly shown in Fig. 6. A 15° nose angle (sometimes referred to as the corner angle) is standard for these Kennamills. The 15° blade angle is changed to a suitable cutting angle and, in this instance, for steel to a 7° negative angle. The 7° negative axial rake angle is also a part of the specification for the Kennamilling of steel.

Characteristics of Kennamilling

With this brief introduction to the nature of Kennamilling we will now proceed to a consideration of the characteristics of Kennamilling in terms of actual shop operations currently being performed.

The milling of a cast iron component as shown in Fig. 7, though a simple operation, presents the opportunity to set forth some of the outstanding characteristics of the carbide milling of cast iron. This workpiece is a hydraulic pump component, and the specifications called for an unusually good finish, such as would permit its assembly without benefit of a gasket. Moreover, it was desired to obtain this surface condition in the most economical manner and with the least number of operations.

*This article is a sequel to "Cemented Hard Carbide Compositions" by Philip M. McKenna, published in March, *The Tool Engineer*. Both papers had originally been scheduled for presentation at the cancelled 1946 Semi-Annual Meeting, A.S.T.E., Pittsburgh, Pa.

FIG. 1.

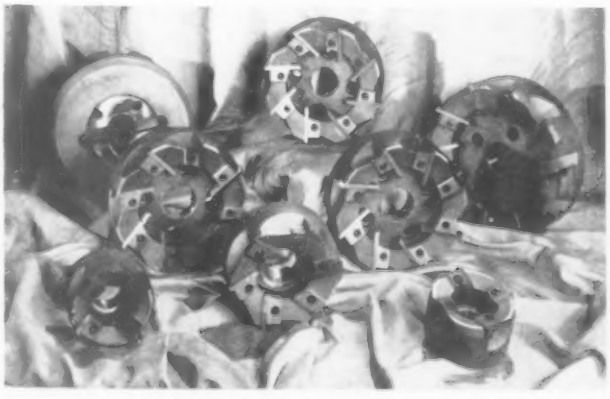


FIG. 2.

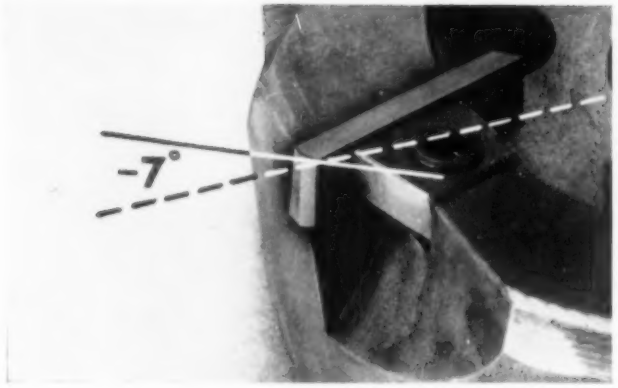


FIG. 3.

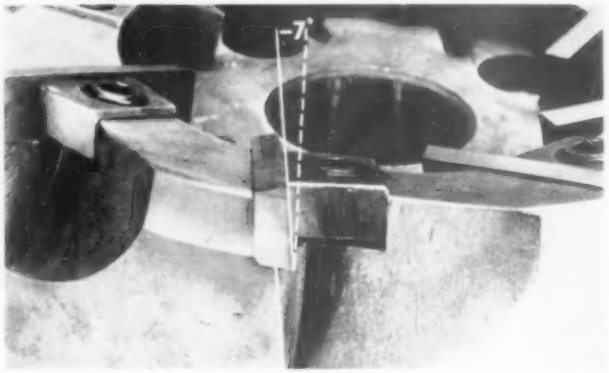


FIG. 4.

Here, an 8" diameter face Kennamill is mounted on a spindle revolving at 150 rpm which corresponds to a surface foot rate of 300. (Cast irons, of normal specifications, are usually carbide milled at surface foot rates in the neighborhood of 300.) The table feed here is 24 inches/minute which corresponds to a chip load of .020". This is possible with Kennamilling for reasons to be explained subsequently. A finish of 20 microinches, with acceptable flatness, is obtained in this manner.

A dish angle of zero degrees with a dish angle line of length equal to .160" is used to obtain this finish. In Kennamills, with all blades set in the cutter on the machine, the high blade (ground as previously explained) will act as a fly cutter or a rotary broach and will produce the finish referred to.

Carbide milling is performed without use of a coolant. The advantages of "dry" milling are more indirect than otherwise. That is, the economies of dry milling are insignificant as compared to such by-product results as cleanliness of operation and greater facility for the operator. The milling of a large component (the base of a lathe, a product of a machine tool company) is shown in Fig. 8.

Superior Finish on Mating Surfaces

Here, an 8" diameter face Kennamill is again used to mill one of the long mating surfaces on this base. This is again performed at a surface foot rate of approximately 250 (spindle speed of 125) which is the top spindle speed available in this large planer type milling machine. The table feed is 18 inches/minute which represents an increase of 13 inches/minute. The previous rate with high speed steel was 5 inches/minute. The superior finish obtained is indicated by a profilometer reading of 25 microinches.

The carbide used for this operation is a straight tungsten carbide (K6) with the following cutting angles: a 10° positive radial rake angle, a 7° negative axial rake angle, and a 15° nose angle.

Cutter Re-Conditioning Simplified

The re-conditioning of these cutters is simply and easily accomplished. They are removed, when dull, by means of an Allen wrench, from the cutter body. They are then placed one by one, in the grinding block shown in Fig. 9, whose 4 detail illustrations present the simple operations necessary to re-condition these blades. In sectional photo "A" of Fig. 9, the OD is being ground; in "B" the secondary OD is being ground; in "C" the cutting land is being ground (in this instance a 10° positive radial rake angle); and in "D" the face cutting angle is being ground.

All of these grinding operations are performed on a simple surface grinder designed specifically for this technique. The diamond wheel is a 200 grit 6" diameter 3/8" wide face 1/8 depth of diamonds with 100 per cent concentration. The grinding block used has incorporated in it all of the angles with the faces marked so that if set on face "A" and consecutively on "B," "C" and "D" the grinding operations shown will be correctly performed.

The application of a Kennamill to a horizontal boring mill (as a Giddings & Lewis) is shown in Fig. 10. Here, the simultaneous use of horizontal and vertical feeds makes it possible to profile this large cast steel casting. The surface foot rate used here (as is recommended for cast steel) is approximately 300 surface feet/minute. The feed rate of 12 inches/minute—in either the horizontal or vertical direction —results in a combined feed rate of approximately 17 inches/minute.

Horizontal boring mills are also ideally suited for carbide milling, provided the workpiece is rigidly held and an exten-

FIG. 5.

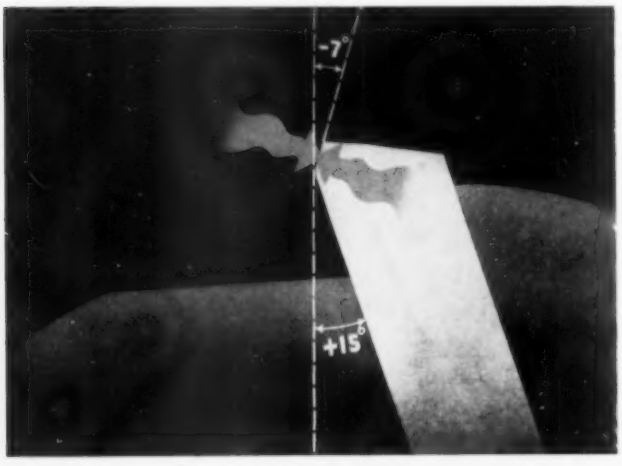
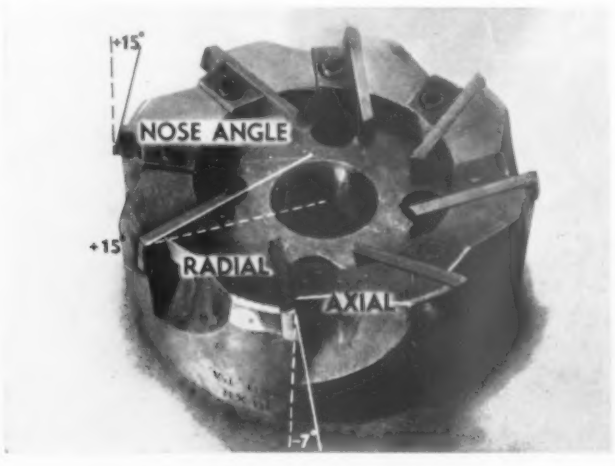


FIG. 6.



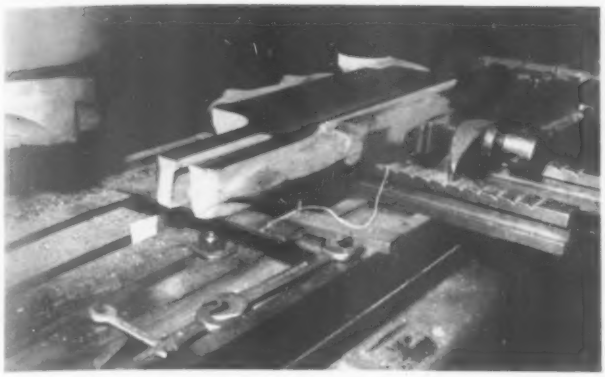


FIG. 7.

FIG. 8.

sion of the spindle of not more than 12" to 18" is used, depending upon the depth of cut and the feed rate. Here, again, "dry" milling is used, and the increase in the production rate of 250 per cent is significant.

Another application of Kennamilling, on a horizontal boring mill, is shown in Fig. 11. Here, the profiling is artistically done by a skilled operator, again using both the horizontal and vertical feeds. This component is of cast iron, specification for which a surface foot rate of 300 is again used. The feed rate of 22 inches corresponds to a chip load of approximately .019". This compares with a feed rate of 3 inches/minute when using high speed steel cutters.

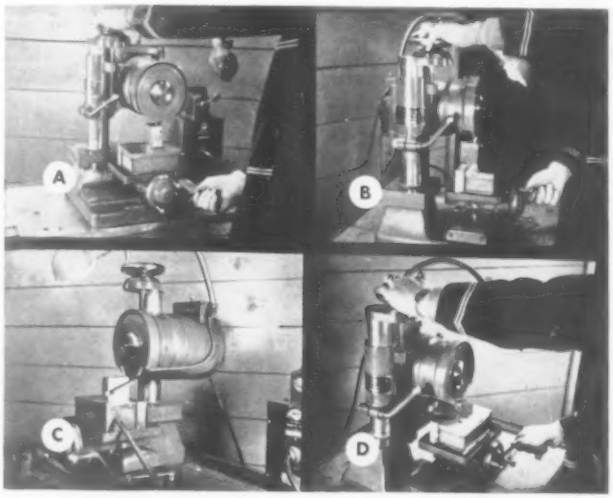
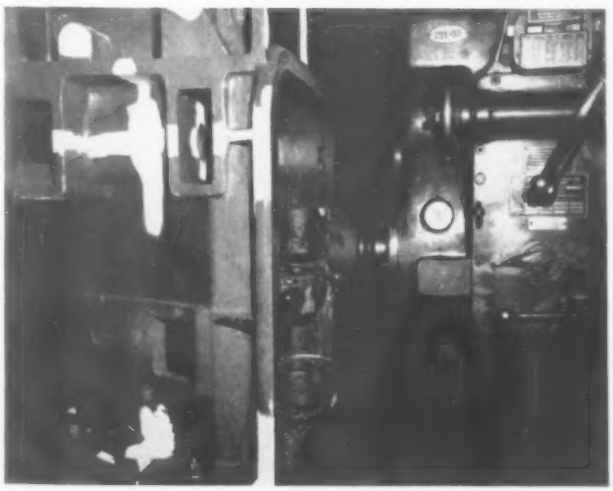


FIG. 9, ABOVE.

FIG. 10, BELOW.



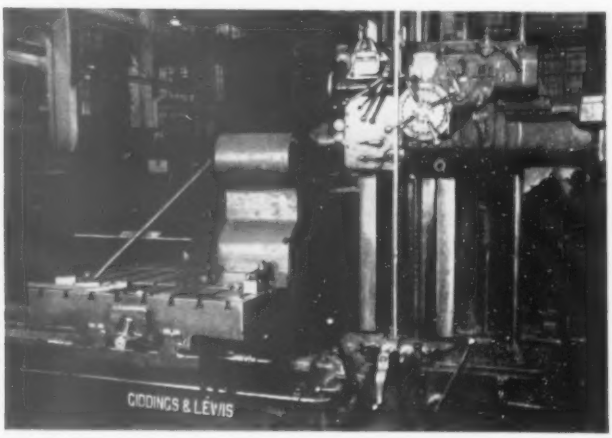
The problem of milling large surfaces to replace planing is clearly illustrated in Fig. 12. These two components—each weighing 26 tons—were placed upon the bed of an 8" horizontal mill, and 5" wide cuts were taken. Since this is a weldment of steel, a surface foot rate of 500 was used and hence the spindle speed was approximately 230. The 8 bladed cutter was set at a rate of 25 inches/minute, corresponding to a feed rate of approximately .010". The machining time, in this instance, was reduced from 120 hours to 18 hours (the former being accomplished by planing). The 5" wide surfaces blended so perfectly that division lines are not perceptible to a profilometer—largely due to the use of a superior machine tool. The use of carbide is important since it does not wear, and thus mill surfaces at varying depths.

Dimensional Relationship Retained

Since Kennamill blades are ground individually, and set in the cutter bodies on the job, it does not become necessary to destroy the dimensional relationship between the cutters and the workpiece in order to re-condition the cutters. The blades are simply removed, ground, and then replaced in the cutter bodies whose position on the arbor has not been changed. The method of setting these blades in the cutter body on the job will be subsequently explained in detail.

Milling is frequently uneconomical in a small organization owing to the expensive equipment necessary for cutter grinding and re-conditioning. Kennamilling, however, makes possible the use of milling technique in a shop organization not equipped with expensive grinding apparatus. In small manufacturing plants, the re-conditioning of cutters is simply and economically accomplished by grinding the blades individually in a grinding jig on a surface grinder, as previously explained.

FIG. 11.



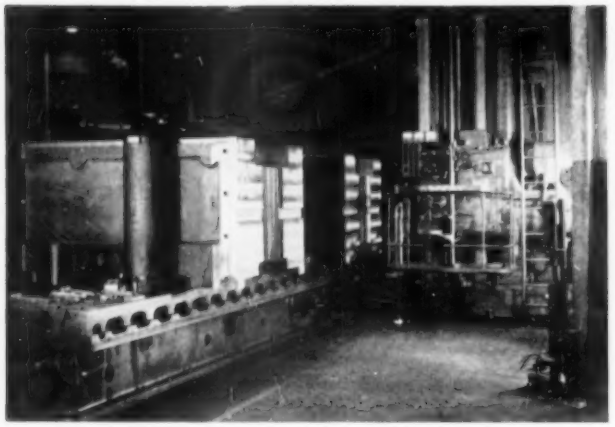


FIG. 12, LEFT.

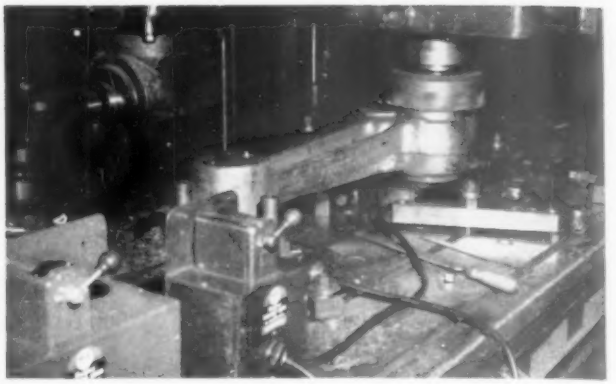


FIG. 13, ABOVE.

The large 10" face Kennamill as shown in Fig. 13 is being used to mill a connecting rod (approximately 5 feet between wrist pin and crank shaft centers) on the bed of a large planer type milling machine. Perhaps the most significant feature of this operation is the use of a Rockford Magnetic Power Grip chuck to hold the workpiece. Except for the end stops, as shown, this large cast steel component is held by means of these powerful chucks. Frequently, production personnel complain that, while carbide milling does reduce the cutting time, it cannot and does not affect the handling time. The combination of a power magnetic grip, as shown, answers this difficulty.

A similarly interesting application of both Kennamilling and a power grip magnetic chuck is shown in Fig. 14. Here, a large power gas cylinder head is being milled, again on the bed of a planer type machine. The 10" diameter cutter shown in use is being revolved at a spindle speed of approximately 150, resulting in a surface foot rate of 300 which is suitable for this cast iron material. The feed rate of 15 inches/minute corresponds to a chip load of .010".

Low Power Consumption

It is significant that the horsepower consumption for this operation is approximately 10, which corresponds to a *K* factor, or horsepower/cubic inch/minute rate of metal removal of .7, which means this material is being removed at a consumption of .7 hp/cubic inch/minute. This is one of the significant features of Kennamilling, namely, the extremely low rate of power consumption. It is thus possible to remove twice as much metal for a given horsepower, and therefore a particular machine, as is possible with other techniques or carbide cutter.

In Fig. 15, the profile milling of a flange on a large casting is shown as performed on a G & L boring mill. Here, the skill of the operator makes possible the profile milling of the 3" wide flange. An 8" diameter cutter is mounted at the end of the spindle, which is held as close to the column face as possible. This operation, as performed with carbide, represented an increase in the cutting rate of approximately 75 per cent over high speed steel. A surface foot rate of 300, and a chip load of .010" is standard for such operations and represents good practice.

Milling of Magnesium

Fig. 16 shows the milling of magnesium, at the remarkable surface foot rate of 12,100 feet/minute (6,000 rpm) and at a feed rate of 300 inches/minute. The machine used is a Sundstrand No. 33 Milling Machine with gear driven spindle and equipped with a 25 hp motor. The most significant result, in this application, is the surface condition of approximately 5 microinches.

It appears that no one has yet determined the "ceiling" for the milling of these materials. Aluminum, likewise, is milled under the same conditions of surface foot rate and table feed. Thus, the possibilities of the further and wider application of these materials seems unlimited, insofar as the problems of processing with carbide are concerned.

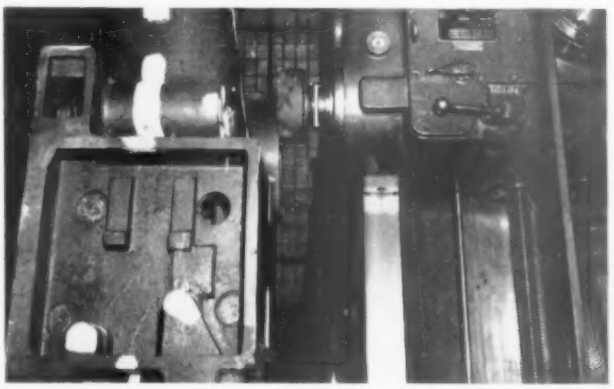


FIG. 15, ABOVE.

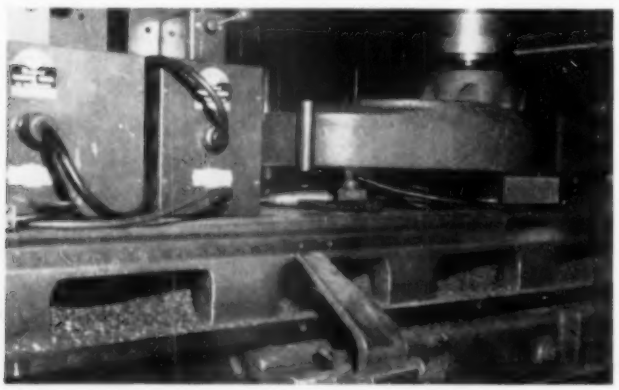


FIG. 14.

FIG. 16, BELOW.

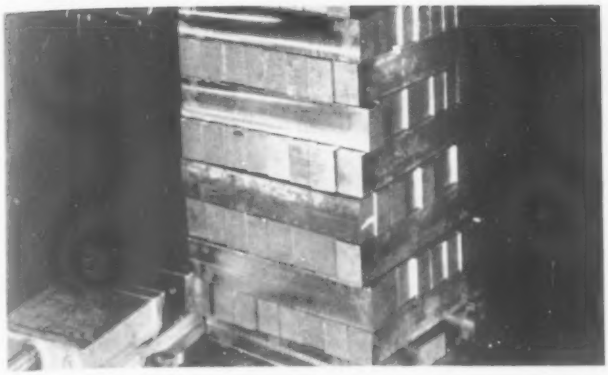


FIG. 17, ABOVE.

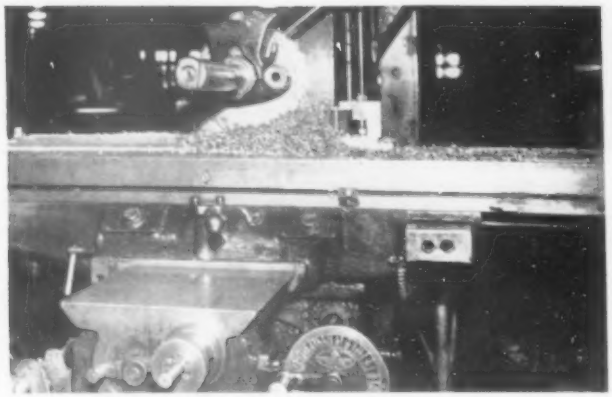


FIG. 18, RIGHT.

In the following illustrations (beginning with Fig. 17) are shown significant results obtained from applications of Kennamilling to a production operation in a motor manufacturing plant. In Fig. 17 are shown pole pieces used in a large 650 hp motor for a subway transportation application. The material is an 8 to 15 carbon steel whose Brinnel is approximately 110. This soft, low carbon steel presents some unusual machining problems that have been effectively solved as follows:

Prior to the introduction of carbide, one of the more important operations performed on these pole pieces was straddle milling to a $1\frac{1}{4}$" dimension. This is pictured in Fig. 18 where the feed rate of $1\frac{1}{8}$" per minute is clearly presented. Fig. 19 presents the first step in the conversion to carbide for this same operation. A magnetic chuck was used to hold the workpiece; yet, the operation was performed with 10" diameter half side mills, using 10 solid carbide blades of a K3H composition for steel.

The last step, in the conversion to carbide, is shown in Fig. 20, where a simple 6" diameter facemill, mounted on the horizontal spindle of a knee-type Milwaukee milling machine was used to mill these pole pieces.

The spindle speed is 326 rpm, which corresponds to a surface foot rate of $508\frac{1}{2}$ feet/minute, and table feed is 60 inches/minute which, in turn, corresponds to a chip load of .030". These cutting rates may be compared to a spindle speed of 27 rpm with high speed steel and $1\frac{1}{8}$" feed per minute. The saving, due to conversion to carbide, was approximately 65%—really a good interest on the investment.

Carbides Effective for Small Lot Runs

Benefits to be derived from use of carbides, in metal processing, are by no means confined to mass production. As typical of small lot runs, a boiler plate component was being milled at the rate of less than 4 pieces per 8 hour day —the maximum, because of the tearing action of high speed steel. When carbide cutters were used, the output soared to *10 pieces per hour*! All told, the several cases cited are typical of the many economies to be effected with the use of carbides for the machining of metals.

FIG. 19.

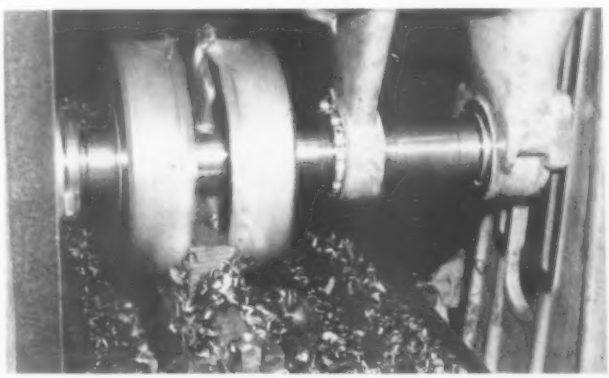
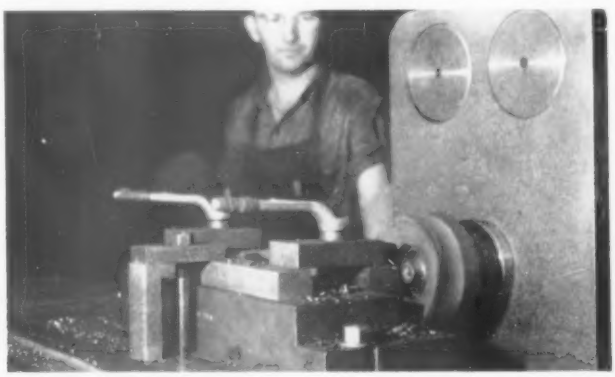


FIG. 20.



Increased Demand for Quality Measuring Instruments

INDICATIVE OF TRENDS in quality measuring instruments, the future may bring forth small instrument boards suitable for table top mounting before a single operator, and utilizing 1 inch instruments. These reduced control boards will supersede large supervisory instrument control boards now requiring entire buildings for their housing.

Such changes were predicted by H. D. Middel, engineer with General Electric Company, in connection with a paper presented at the recent Winter Convention of the AIEE. Among other things, the conventional wide chart or round paper-type recorder may be entirely eliminated. They will be replaced with wire recorders to provide means for recording plant performance, along with audio-tone signals whose frequency is a measure of deviation. For high-accuracy indication, clock-hand type motor-driven servo instruments, with a 100 inch effective scale length in a 4 inch instrument case and having a full scale time of 5 seconds, show real promise.

According to Mr. Middel, the real demand in measurement leading to automatic control, is for devices which more closely measure the quality of a process. While such measurement is difficult to obtain now, and is therefore an achievement of the future, he did feel that it is in this direction that electronic instruments will have their greatest influence.

By Howard Coonley and P. G. Agnew

The Role of Standards in the System of Free Enterprise

A Study of Voluntary Standards as Alternative to Legislative and Commission Control. Prepared by Request of Temporary National Economic Committee

Part Two of Two

IT IS EVIDENT that statute law cannot keep pace with industrial progress. On the other hand the standardization method can do so. For example, a year after the national safety code for grinding wheels was first issued, there were two important accidents following developments that could not be foreseen during the formulation of the code. Within a few months the necessary researches had been carried out, and provision to take care of the new condition was under way.

Flexibility of the Standardization Method

In contrast to this flexibility is the rigidity of legislative enactment. Years ago the state law of Pennsylvania laid down in detail how blasting in coal mines is to be conducted. Research has developed an improved technique which not only reduces the life hazard in the mining of coal but makes possible very definite economies in production. Yet the introduction of the safer and more economical technique is prohibited by the law.

For such reasons, the industrial states are more and more handling such specialized industrial matters as come under legal control through regulatory commissions rather than through legislative enactment. Many experienced commissions are following a policy of getting all the interested groups together to agree upon a solution, and then formally ratifying this solution. A case in point is the reliance placed upon the program of national safety codes by the state industrial commissions. Another extremely interesting example is in the "trade practice conferences" of the Federal Trade Commission, in which the industry agrees upon trade practices, subject to the ratification of the Commission, and which then become criteria of fair and unfair trade practices.

Controversies between industrial groups frequently develop in standardization work just as they do in legislatures, but are practically always on what appear to the contesting groups as real issues. The work is not often bedeviled by anything corresponding to the partisan game of using real issues as pawns for ulterior stakes.

Solution Rather than Compromise

A far more important advantage over political methods is that generally these controversies are threshed out, often with the aid of research, until a reasonable solution, in contra-distinction to mere compromise, is reached. It is in contrast to the frequently bemoaned fact that so large a part still goes by the royal road of issuing decrees—for decrees they are, whether issued by executive, court, commission, legislature, or popular vote—instead of seeking the facts, and through them, a solution which will command a consensus. As is so frequently remarked, questions "settled" in this way often do not stay settled because they have not been solved but only decided.

By thus constantly striving for *solutions*, the standardization method tends to get down to fundamentals, instead of being content with superficial patchwork which all too often characterizes political methods. This difference is well illustrated by building codes. For many years it has been the custom of a number of industries in the building materials field to lobby before city councils and building departments in order to get such provisions written into local building codes as will give them a competitive advantage commercially. This situation is objectionable from the civic point of view. It is costly and wasteful for the industries involved, partaking as it does of the nature of a vicious circle.

A comprehensive effort is being made to improve this situation through the development of a series of national standard codes, in which requirements are stated as far as possible in terms of performance instead of in terms of particular materials. For example, the fire resistance of materials and of construction is stated in terms of one-hour, two-hour, etc., ratings under specified fire tests, instead of requiring particular materials. This policy, which is that of finding fundamental solutions, puts all the industries concerned upon a fair and equitable basis. It encourages, instead of excluding, new materials and processes. The work is being carried out under the auspices of the American Standards Association, with the close cooperation of city building officials, the National Bureau of Standards, and the various industrial and technical groups concerned.

The essence of the advantages of the standardization method is the simple, direct relation which the groups concerned in a problem have in its solution. This gives it the vitality of elementary local self-government. Each technical committee, made up as it is of representatives of all interested groups, is essentially a miniature industrial legislature organized upon an industrial instead of upon a geographical basis.

This is in sharp contrast with the weakness of the political method, which pyramids up to the one grand "decision" of vague generalities in a national election, which is thus theoretically supposed to furnish a mandate for deciding thousands upon thousands of problems through a descending hierarchy of bureaucracies.

Limitations of the Standardization Method

The standardization method has its limitations and difficulties, most of which, as would be expected, are very similar to the difficulties and breakdowns encountered by other types of human agencies, governmental or voluntary, legislature or court, church or lodge.

The interested groups are often very unequal in strength and influence. Also they may be unorganized or very loosely organized, as is not infrequently the case among consumers as compared with producers, or small retailers as compared with manufacturers, a condition which often constitutes a serious handicap in standardization work.

There is much jockeying for immediate commercial advantage. There are endless jealousies and bickerings within and between organizations, and struggles over the prestige and vested rights of organizations—the nearest equivalent of party politics.

Most Americans do not understand the meaning of representation and its responsibilities—a source of serious weakness in nearly all forms of voluntary organization as well as in our government. (This is probably due to the fact that we are accustomed to speak of our government as being representative, while it is not representational in the sense that a parliamentary government is representational.) A closely related fact is that it not infrequently happens that men agree at the council table to an undertaking, with inten-

tions of carrying it out, and then later fail to do so. This is one of the most frequent causes of breakdown in undertakings under the cooperative method.

Then there is the problem of the "recalcitrant minority" (which in some cases is strongly organized and powerful) that refuses to cooperate unless it can have its own way completely. Frequently, in the opinion of the majority, such a group is not intelligent enough to know what its job is, and what in the long run will be most advantageous to it. In standardization work this difficulty is one which is much more apt to prevent the launching of a project than to wreck one after it is started, although instances of the latter do occur from time to time.

Of course, these and other difficulties are inherent in any important movement.

What Should Not Be Standardized

There is no value in standardizing merely for the sake of standardizing, in uniformity for the sake of uniformity. To do so takes variety and spice from life.

Standards should be set up only when doing so may be expected to result in important economies; to simplify and clarify operations; or to safeguard persons or property.

It is idle to attempt to standardize style features.

It is not the function of a standard to prevent the marketing of any product, no matter how inexpensive, but merely to enable the buyer to know what he is getting.

Most business men think that the use of standards for commercial and technical purposes should be voluntary, and that they should be made mandatory under legal authority only when such a course is necessary as a protection to persons or property or to prevent fraud.

Forms of Business and Social Control

Five forms of business and social control have been mentioned which have been developed in all Anglo-Saxon countries. Each stage was developed as the preceding stages proved too slow to keep pace with economic and social changes, especially as these changes have been accelerated by technologic development.

1. Folk ways.
2. English common law. This method developed with the breakup of feudalism.
3. Statutory law. This started its great development with the advent of the industrial era.
4. Regulation by commission. This form combines in one body many executive, judicial and legislative functions. It permits the breakdown of issues into detailed questions, and is more flexible than the legislative method.
5. The method of consensus through voluntary cooperation. This method seeks fundamental solutions of questions small enough to be handled by a committee on which all groups concerned are represented. It operates not by simple majority vote, but on the principle of obtaining a solution sufficiently basic to command a consensus of those substantially concerned with the question in hand. This method has been most highly developed in the field of standardization.

The first and second of these, folkways and common law, attained a consensus as the result of the slow, evolutionary process by which they developed.

The third and fourth, statutory law and regulation by commission, are based upon the principle of majority rule, and hence often fail to secure a consensus. This often leads to faulty administration of law, and sometimes to complete breakdown, as witness the Volstead law.

The fifth method, that of seeking a consensus of those concerned through voluntary cooperation, is not spectacular. It requires patient, exacting work. A single industry often requires scores, even hundreds, of standards to guide it in its operations. Each standard is an undertaking in itself which, when completed, becomes one single element in a mosaic which has to be patiently built up, bit by bit, standard by standard. But since each standard represents a consensus of those concerned with this particular problem, the resulting mosaic can be made to fit the needs of the industry extremely well.

At the present time there is the most widespread criticism on the part of business that it is being over-regulated. Yet there has been, and still is, too little constructive action on the part of industry as a whole in taking hold of untoward situations and working out solutions before they get out of hand. There are exceptions, the outstanding one is the standardization work that has been done in the more technical engineering industries. Yet, if we were to list all of the regulatory agencies that are now operating under the authority of the Federal and state governments, we would find very few cases in which, prior to the establishment of an agency, industry has made a determined effort in an organized way to cure the situation on its own initiative.

Business has in this country no one organization which speaks for it in over-all policy matters. The three principal organizations of a general nature are the National Association of Manufacturers, the Chamber of Commerce of the U.S.A., and the National Industrial Conference Board. While all of these three organizations have interested themselves in a minor way with the use of standards as a means of self-regulation of business, they have not treated it as a matter of major importance.

Our free enterprise system cannot survive under a policy of mere negation. In the absence of an organized constructive policy on the part of business, any situation which gives rise to bad public relations is likely to lead to the intervention of government. Mr. Justice Frankfurter has said, "It is too often overlooked that government as a rule undertakes no services or regulations except after private agencies have proved themselves incapable or unwilling."

It is an axiom that power unused is lost by its possessor. Hence, business can ill afford to continue a course of inaction.

Problems of the type which may lead to government regulation if not solved by industry are already numerous and are bound to increase rather than decrease in number. A few of these deserve special mention.

Nat'l Standards as Preventatives of Trade Barriers

Hearings before the Temporary National Economic Committee have revealed a large number of trade barriers which are inimical to the national economy.

In his testimony, Frank Bane, executive director of the Council of State Governments said: "Hundreds of trade barriers are today obstructing the free flow of commerce among the states. Such measures, which in practice violate the spirit, if not the principle, underlying the commerce clause of the Constitution, are on the statute books of almost all the states. They are enforced generally under the state police and taxation powers, operate to benefit local producers and distributors, and tend to stimulate political and economic sectionalism."

Many of these barriers are local standards in the form of regulations of state governments; some are city ordinances; and others result from generally confused situations. It is clear from the hearings that most of these barriers could be removed—or better, could have been prevented in the first place by national standards.

This is well illustrated by the experience of the American Standards Association, whose work has led to the elimination of a considerable number of barriers. A group of voluntary standards for gas appliances has led to the elimination of restrictive ordinances in some fifty cities, resulting in a national market unencumbered by local restrictions. A refrigeration code has performed a similar function for the

market for household refrigerators; and two electrical codes have been major factors in keeping a free national market for electrical appliances.

In like manner, American Standard Safety Codes covering many types of machinery, such as punch presses, grinding wheels, elevators, gears, and shafting have cleared or have kept clear of state and city barriers, national markets for these products. The unification has included the requirements of the casualty insurance companies, which were formerly frequently in conflict with state requirements.

When the present system of the control of highway traffic by light signals was introduced some years ago, there was great confusion in the use of colors. In one place, green meant "stop," in another it meant "go," and so on. Complete national uniformity resulted from the development of the American Standard Code of Colors for Traffic Signals. Similarly, local barriers have been removed, and highway traffic has been facilitated by national standards for traffic signs, for safety glass, and for the inspection of motor vehicles.

A large part of the trade barriers now existing in this country could be eliminated by the development and use of national standards for the products and operations concerned. The constructive examples cited constitute a mere beginning. If this simple and obvious means of removing barriers is to become effective, the initiative should be taken by the leaders of those industries which are adversely affected by the barriers.

Employer-Employee Relations

There are a number of areas in the field of employer-employee relations which would greatly benefit by national standards. As has already been pointed out, substantial progress has been made in removing the safety sector from the field of controversy. In this, fifty American Standard Safety Codes have played an important part.

A sound basis is being laid for a similar group of codes for the prevention of industrial diseases. This first step is to limit the allowable concentration of toxic substances which are used in industry in such a way as to endanger the health of employees, unless properly safeguarded. Particularly important are dusts and gases. Four codes for this purpose have been developed and work on a score of others is under way.

Individual labor leaders have at times suggested that standards to define specific tasks, if worked out by cooperative effort, would have saved much controversy.

There has been much need for a standard classification of occupations. It would be helpful in jurisdictional labor disputes. The War Department has been developing such a classification in connection with defense needs.

Standards for Consumer Goods

A small vanguard of manufacturers and distributors are introducing the use of standards into the consumer goods field, and most of what has just been said about standards for producer goods applies with equal force to standards for consumer goods—broadened markets—more democracy of business opportunity—buyer and seller speaking the same language. Such standards help to channel the goods from the manufacturer, through the wholesale and retail markets to the ultimate consumer.

The demand for standards to define products lies at the very heart of the consumer movement. This has been very clearly and incisively stated on a number of occasions by representatives of the American Home Economics Association, the American Association of University Women, and the General Federation of Women's Clubs. For example: "Our economy of free enterprise is based on the assumption that the consumer will be able to judge quality and price and that he will be able to detect and shun fraudulent products. We believe that the best way to enable the consumer to exercise his alternative proper role is through the development and general use of standards for staple goods offered for sale on the retail market.

"Such standards may be in the form of specifications for one or several grades; they may be definitions of words to be used for certain products, such as the rayon and fur trade rules; they may be sizing of garments on the basis of body measurements. Since standards are sought for products, not people, matters of individual taste, such as fashions, are outside their scope.

"One of the major factors in intelligent income-use is ability to identify the relation between price and value of goods and services, so the individual may select those best adapted to his needs at a price he can afford to pay.

"If it were possible for the consumer to do this, we would need fewer regulatory laws and protection from fraud would become a less expensive public problem. In the last analysis, concealment of the relative worth of goods and services is a kind of fraud, though it is not generally recognized as such.

"Everyone recognizes that price would mean nothing without knowledge of *how much* was being offered at a given price. Those interested in income-use believe that price is equally meaningless without knowledge of *what* is being offered at a given price. Buyers are helpless in trying to compare the real value to them of two pairs of silk hosiery, two suits of clothes, or two mechanical refrigerators at different prices when there is no way for them to make accurate comparisons between their quality and performance in use."

Certification and Labeling

Labels on the goods which state that they comply with a particular standard provide the most practical way of informing the individual consumer that the goods do comply with the standard. Drugs which comply with the requirements of the U. S. Pharmacopoeia are easily identified by the letters "U.S.P." on the labels. Recently several manufacturers and distributors of canned fruits and vegetables have begun to grade-label certain of their products according to grades established by the U. S. Department of Agriculture.

Industrial purchasers generally have means of checking their purchases to make sure that the product complies with the specifications upon which the order was placed. But the individual does not have any means of checking his purchases to make sure that they comply with the standard as represented to him by the seller.

This lack can be filled by systematic testing and certification by an independent laboratory or similar agency. For example, specifications for household lamps have been developed by the Illuminating Engineering Society which assure good, adequate lighting, free from glare. This "IES lamp" is being manufactured and marketed by any manufacturer who is willing to meet the specifications. Compliance is controlled by testing and inspection by an independent laboratory, and each lamp is labeled to certify compliance with the specifications. This use of standards, inspection, and labeling, is a notable development in merchandising. Underwriters' Laboratories operate a somewhat similar system, but their work is limited to features having to do with fire and casualty hazards.

Plans have been prepared for a general organization to carry out these functions of testing, inspection, certification and labeling of products—functions which are particularly important in the case of consumer goods—all to assure compliance with nationally recognized standards—and all carried out through the cooperation of manufacturers, distributors, consumers and publishers. Such plans have been developed by the Institute of Standards, but they have not yet been put into operation.

Standards Needed to Determine Truth or Falsity of Advertising

Standards in the consumer goods field relieve advertisers of a dilemma. One of the most important reasons that efforts to establish "truth in advertising" have not met with a much larger degree of success is that so few definitions have been agreed upon. Consequently differences of opinion as to what constitutes truth still persist.

For example, when in advertising "Hudson Seal Coats" a few years ago, many, if not most, readers of the copy thought that the fur had grown on the back of a seal. But when "Dyed Muskrat" was added, a standard was being used—an agreed-upon definition—and there was no chance of misunderstanding.

Unfortunately even where definitions have been available, the refusal of many business organizations to use them in advertising and on labels has caused resentment on the part of consumers, and has led many of them to seek legislation as the only effective remedy.

Standards Reveal Concealed Price Increases in Periods of Changing Price Levels

Standards for consumer goods also relieve the retailer of a dilemma. When in order to meet changing price levels the manufacturer lowers the quality of a product in fixed price lines there results a concealed price increase. This is frequently the cause of consumer complaint. The Bureau of Labor Statistics in its retail price studies has found it necessary to set up a large number of rudimentary specifications to define the products being priced, in order that the data may be comparable.

It is thus seen that the consumer movement presents to business a public relations problem in relation to standards that is of far reaching importance. A survey to determine the extent and penetration of the movement was made by Dr. George Gallup for the Association of National Advertisers in 1939. Fifty-three per cent of those questioned were interested in the standardization of products, and twenty-four per cent of them had read one or more consumer books. Forty-nine per cent of those who knew about grade labeling believed it should be made compulsory by the government. From the data it was estimated that there are ten to twelve million of the more literate population of the country who have a fairly intelligent view of the consumer movement.

A repeat survey made by Dr. Gallup a year later showed that the movement had grown, and that in some respects it was becoming a bit more conservative.

Importance in National Defense

The defense program brings the whole subject of standards into sharp focus. A manufacturer who takes a contract for a product which differs from his regular line of production is faced with the necessity of making many changes in the equipment and operation of his plant. His problems are much like those of an automobile manufacturer in retooling for a new model. These problems are basically problems of standardization.

Every government order carries with it the specifications or standards that define the gun, tank, blanket, or truck that the manufacturer has to make, or the materials that he has to supply. A single government order may extend to hundreds of companies—manufacturers of parts or suppliers of materials. Many of the companies will not have had experience with these particular products. Each of them in turn must control all his operations so that the completed product will comply with the standards originally laid down as a part of the order. Hence every one of these manufacturers must have a thorough understanding of standards—how to work to them in shop, processing plant, and assembly line.

The use of standards in the purchasing of supplies by federal, state and city governments is closely related to the defense program and it presents a major opportunity for economy, principally to the public agencies, but also to a considerable degree to the business suppliers. The same is true of institutional purchasing generally. The Federal Government, a few states, and some cities have made outstanding progress in this field with resulting large savings. It has been estimated that the various bureaus and agencies of the Federal Government have in all some 7,000 specifications for the materials and supplies which they purchase. This covers both civil and military needs.

Partly as a result of the work of the Defense Commission, and partly as a result of criticisms by industry of troublesome differences in specifications used by the different bureaus and departments, the Government has plans under way for bringing all government specifications into closer accord, as has already been done in the case of some 1,300 specifications which have been unified under the authority of the Federal Specifications Executive Committee. This Federal Specifications work is attached to the Procurement Division of the Treasury Department. To help bring the work into closer accord with industrial practice, the Treasury Department has recently affiliated with the American Standards Association as a Member-Body.

The integration of the entire process into a smooth flow like a great river system is an enormous undertaking. Shortcomings in the government standards or in the manufacturers working to them—too many kinds of products—obsolete requirements—unnecessarily close fits—faults in workmanship or materials—all result in bottlenecks which cut down the flow of the goods. A great many of these bottlenecks are due to a lack of adequate national standards acceptable to government and industry alike.

Summary

1. It is a commonplace that standardization has been an essential factor in the great increase in the real incomes of the populations of industrial countries since the latter part of the nineteenth century. This is because standards underlie all mass production methods, and because they facilitate the integrating processes necessary to large scale production and distribution.

2. Most of the criticisms that have been directed against standardization have been based upon the misconception that standardization means to stand still. To an industrialist a sound standard represents the best way of doing a thing—at the moment. If tomorrow he finds a better way, he will codify it in a new standard. Sound standardization is dynamic, not static. It means, not to stand still, but to move forward together. By facilitating the flow of products through industry and commerce, standards help to maintain what an engineer would call *dynamic stability* in industrial processes—just as a motor car in motion or an airplane in flight will respond with nicety to the slightest touch on the controls, and will right itself instantly following any slight disturbance—such as a bump in the roadway or a gust of wind—provided the machine has dynamic stability. The danger of stagnation lies, not in the use of standards, but in taking a fixed mental attitude, instead of always keeping the mind receptive to new ideas.

3. In standardization business has available a simple method of avoiding a great deal of governmental regulation, by solving many types of problems which give rise to it step-by-step, and doing so as they arise—instead of waiting until they pyramid into unmanageable form, resulting in legislation.

4. To accomplish this, industry will have to adopt the policy of taking the initiative in constructive action; the present trend cannot be changed by inaction. None of the principal organized business groups of a general character has adopted such a course as a major policy.

5. It has often been suggested that in standardization work an ideal relationship between industry and government has been developed, namely, that the government departments participate in an undertaking on precisely the same basis as that of any other organized technical, industrial, or consumer group. This means that they participate in proportion to their direct concern with the problem in hand, and to the extent that their technical resources enable them to contribute to the solution, rather than by assuming the direction of the whole undertaking.

6. The lack of a sufficient number of sound national standards is one of the main causes of the growth of trade barriers.

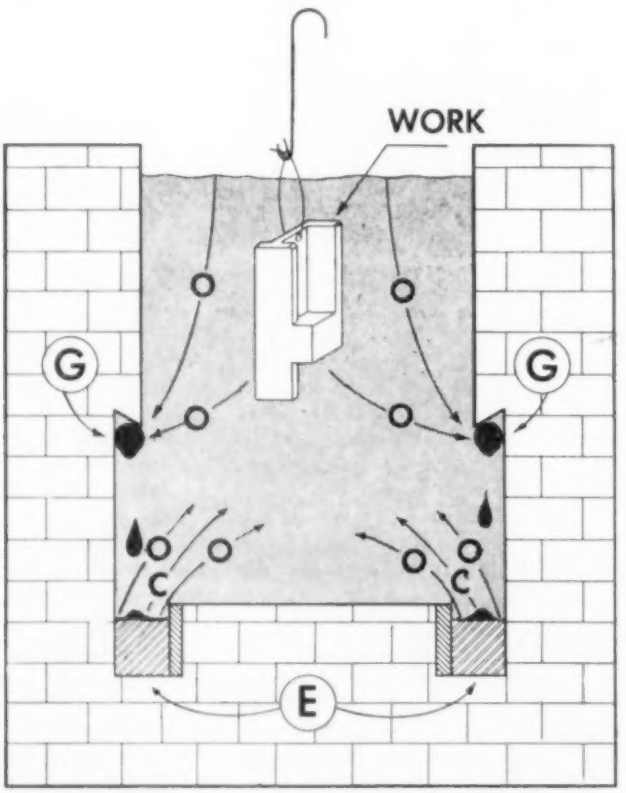
7. The problem of standards for consumer goods is a major one from the point of view of public relations of business.

8. A system of well articulated standards is basic to the defense program. It is equally important in peace time and in times of emergency. While the situation in regard to standards is decidedly better than it was in 1917, there is urgent need for far more coordination, both within industry, and as between industry and government.

Oxides Renew Electrodes in Electric Furnace

SAID TO MARK revolutionary advances in the design and construction of internally heated salt bath furnaces, a new means has been created to automatically renew electrodes which have been permanently sealed in among the refractory matter at the bottom of electric salt bath furnaces. Developed by the Upton Electric Furnace Div'n, 7450 Melville, Detroit, the new process makes use of the natural chemistry of high temperature salt bath furnaces. It causes the electrodes, which are normally wasted away during high temperature heat treating, to renew or "self-perpetuate" themselves.

The illustration shows how oxides, which form in the bath from three sources (contact with atmosphere at the surface, from the work itself and from the electrodes) are employed to self-perpetuate the electrodes. In giving up oxygen, electrodes waste away. Oxides circulating through bath contact graphite rod and are reduced to metallic scale. As carbon content increases, the melting point of scale is decreased. Scale forms in droplets and falls on, and becomes integral part of electrode when carbon content of droplet is reduced.



O OXIDE E ELECTRODE
C CARBON G GRAPHITE ROD

Source of the renewing agent, according to the manufacturer, is the presence of oxides which are normal to any high temperature salt bath. These oxides are automatically generated from three sources: namely, contact of the molten salt (at temperatures of upwards of 200°F.) with oxygen of the atmosphere; the absorption of oxygen from the surface of the work; and the absorption of oxygen from the surface of the electrodes which, by causing a wasting of the electrodes, is the most serious result of the generation of oxides within a salt bath.

To avoid such deterioration, said to be quite rapid when the electrodes are inserted into the bath from above the surface, the Upton designs had previously sealed the electrodes into the bottom of the furnace so as to seal off the atmosphere and its resulting attack. While this greatly increased the life of the electrodes, it did not eliminate deterioration entirely. Now, however, this has been accomplished, by what is said to be a very simple expedient.

The electrodes, of which there are usually two in the average high heat furnace, are located in a slot or pocket in the bottom of the furnace. On each side of the pot, and immediately above each electrode, there is a ledge or overhang of refractory material that is slightly wider than a graphite rod which, being of considerably lower specific gravity than the salt, is thus held against the under side of the ledge by its buoyancy once it is placed in position.

Action Entirely Automatic

The chemical action that takes place as a result of this arrangement when the bath is in operation is entirely automatic. As the oxides contact the graphite rod, they are reduced to a metallic state and, since their melting point is higher than that of the bath, they form a metallic scale on the graphite rod. However, the contact with the carbon rod increases the carbon content of this metallic scale and reduces its melting point until the scale melts and drops from the rod, which is immediately above the electrode. Hence, the metal falls on the electrode.

Here, out of contact with the carbon of the rod, the oxides in the bath will reduce its carbon content until it becomes a solid, integral part of the electrode itself. This process continues automatically until the carbon rod has been consumed, when a new rod can be inserted under the ledge.

In some heat treating operations, this automatic renewal of the electrodes may not be fast enough because of the type of work being treated, or because the graphite rod may not be used. In these instances an "auxiliary" and very rapid means of replenishing the electrodes exists. This consists of simply dropping some cast iron into the bath and, since the cast iron is of lower temperature than the bath, it will melt and run over into the slot. Then, by the simple chemical action outlined above, the oxides reduce its carbon contents so that it becomes an integral part of the electrode.

Thus, by either means, the electrodes never need changing and they will, in fact, out-last the furnace itself.

By **Peter L. Sommer, Jr.**

Precision Lapping by the Centerless Method*

A Simple but Positive Operating Principle Produces Uniform Precision Finish to Less than 2 Microinches

WARTIME PRODUCTION requirements stimulated the search for a method of precision lapping which would combine extreme accuracy and speed with a minimum of operational skill. Centerless lapping was the solution. It met the requirements for a high, uniform finish and eliminated the need for chucking, collets, ring laps, setups, tools, and special attachments for different sizes and types of cylindrical pieces.

***Peter L. Sommer, Jr.*, is General Superintendent of the Size Control Company, Chicago, Div'n of American Machine & Gage Company. Broadly experienced in the gaging and lapping field, he developed the Centerless Lapping Machine, which is the theme of this article, as a spare time hobby. Mr. Sommer is a member of Chicago Chapter, A.S.T.E., the American Soc'y for Quality Control, and the A.S.M.**

Several gage companies led the way by developing centerless lapping machines for finishing their own plug gages. These turned out so satisfactorily on their own production lines that, by request, they are now being offered to all industry. A typical, complete-unit cabinet-type Centerless Lapping Machine, designed and built by the Size Control Company, is shown in Fig. 1.

Principles of Operation

The operating principle is simple but positive, and assures a uniform, polished, mirror-like finish to a precision of less than 2 microinches. Essentially, the lapping mechanism consists of two power driven rollers, one considerably smaller than the other. The smaller roll travels at a relatively slow surface speed and turns the piece being worked at a constant rate.

FIG. 2.

The larger roll is impregnated with lapping compound and rotates at a faster surface speed. The workpiece is placed between the rolls and pressure applied to it by slowly moving a fiber stick back and forth across the workpiece—which subjects the piece to a cutting or dragging action which removes minute quantities of metal. This is shown in Fig. 2.

The entire length and circumference of the piece is thus given a uniform, precision finish. The pressure, exerted on the stick by the operator, depends on the amount of stock to be removed. High sections can be lapped by applying sustained pressure at that point, and diameters smaller than

*This article is in response to requests for information on improved lapping methods.

FIG. 1, BELOW.

FIG. 3, at RIGHT.

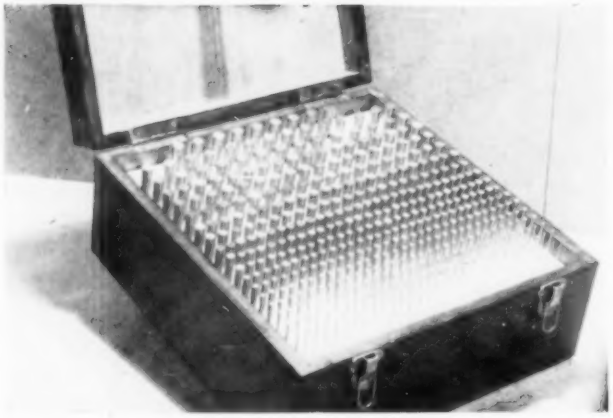


FIG. 4, ABOVE.

FIG. 5, at RIGHT.

shoulders may be lapped by allowing the shoulders to hang over the ends of the rolls.

A simple adjustment, to increase the space between the rolls, permits handling any diameter piece from .003" to 10" with practically no time lost; and many diameters can be handled with no roll adjustment at all. Roll speeds may be adjusted to suit all requirements, and any of the standard lapping compounds can be used. Special compounds are available.

Some degree of heat is generated, since a cutting action is present causing expansion of the workpiece; it is advisable, therefore, to let the workpiece cool in a pan of water, after each lapping operation, so that it will be brought to room temperature. The work is then wiped dry and checked on the comparator.

Among current applications for centerless lapping may be included the lapping of oversize gages; lapping worn gage plugs to next lower size; and lapping bearings, bushings, shafts, or contoured pieces. It should be pointed out, however, that out-of-round condition cannot be corrected, nor can a round piece be made out-of-round.

However, undesirable taper can be removed by exerting pressure on the high sections of the piece. This brings the high spot to the uniform diameter. If ends of piece still run low, the low end is extended over the edge of the rolls while the rest of the piece is being lapped down to the uniform size.

Any intelligent worker can be easily trained to produce precision work, as indicated by the girl operator in Fig. 3. A case of precision pins lapped by this method is shown in Fig. 4; and precision gages for U. S. Ordnance have also been successfully lapped by the centerless method.

Centerless vs. Ring Lapping

Among the several advantages of centerless lapping over previously used ring lapping, the following may be included:

(1) *Accuracy* that insures a precision finish of less than two microinches, with the parting line common in ring lapping entirely eliminated. Fig. 5 shows a finished part being checked on a Brush Surface Analyzer to a reading of ½ microinches RMS.

(2) *Increased production*, because the work can be placed on the rockers, fed to-and-fro, finished lapped and removed without stopping the machine. There is no time lost in chucking and unchucking the work; nor in making, adjusting and renewing lapping rings.

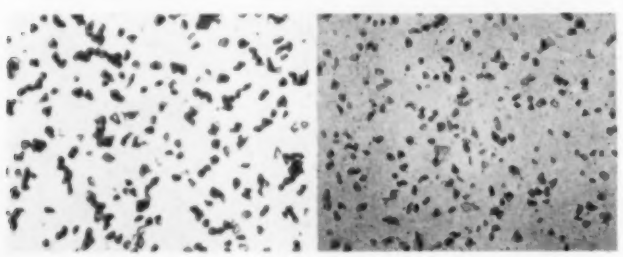
(3) *Versatility*. The Centerless Lapping Machine laps either straight or tapered plugs or pins, with or without shoulders. It handles a wide range of diameters, and contours, without interfering with production; and it requires no special tools or equipment except as contoured rollers may be machined special.

With this newest machine tool—a development of American ingenuity—industry may now add quality operation after grinding to improve finish, add wear life to the part, and size the gages or other round work to extreme accuracy.

Improved Surface Finishes with Uniform Size Diamond Powder

RECENT PHOTOMICROGRAPHS of the diamond powder produced by Sapphire Products Div'n, Elgin Nat'l Watch Co., Aurora, Ill., reveal that Elgin-processed powder is definitely superior to federal standards. An Armour Research Foundation 400X photomicrograph of the Elgin product is shown at left; and, for comparison purposes, a typical U. S. Bureau of Standards 400X photomicrograph has been placed alongside at right.

Size uniformity, cleanliness and efficiency are said to be the most important characteristics of this Elgin diamond powder; and, it is further claimed that practically all particles will cut because of their even surfaces, thus producing a finish without scratching or pitting which is high and uniform. A gun-type applicator, which is illustrated, protects the powder from contamination since it is fully enclosed; and, it is also conveniently designed to meter the quantities of diamonds used.



By **Thomas A. Dickinson**

Report on Plastic Automobiles

Compared to Metal Fabrication, the Tools for Conolon Laminates are Remarkable for Simplicity and Low Cost

SINCE THE FALL of Japan, the American press has periodically carried reports of alleged plans by various manufacturers to produce plastic-bodied automobiles. Some of these were most likely out-and-out publicity stunts, but others were undoubtedly based on good intentions. However, there has to date been little or no published data that would indicate whether such automobiles are practical from anything but a theoretical design point of view.

Mr. Dickinson

Therefore, the author has made it a point to investigate two of the most widely-published newspaper reports and will in this article endeavor to present some of the facts that will enable practical Tool Engineers to draw their own conclusions with regard to the use of plastics in automotive work.

First portion of the investigation was confined to Bobbi Motor Car Corporation of San Diego, Calif., where it was first announced more than a year ago that more than three different models of a light-weight, plastic-bodied automobile would soon be in production. Each design was based on a new 25-horsepower, four-cylinder, water-cooled engine and called for extensive use of a glass-fiber laminate known as Conolon—not to mention such features as independent four-wheel suspension, super-efficient hydraulic brakes, a synchromesh transmission, special clutch, plastic upholstery, and so forth.

Despite all the innovations involved, the Bobbi-car plans appeared to be good and practical. But, strangely enough, none of them appear to have gone beyond the prototype stage. It is alleged that this failure to get into production has been due to a state corporation commission ruling, which has disapproved the plans of Bobbi-car officials to sell stock; but actually the company abandoned plans to utilize plastic bodies long before this ruling took effect, and it is now well known that—if Bobbi-car production gets under way—all models will feature metals instead of plastics.

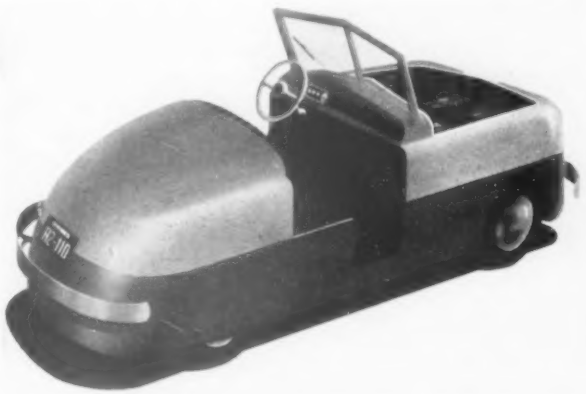
While we do not ordinarily publish articles related to product design, this article by Mr. Dickinson opens new vistas both in automobile production and tooling for plastics. It is therefore pertinent to the know-how of Tool Engineering.

The Editors

Conolon a By-Product

To understand this change of plans, it is first necessary to know something about Conolon—which is really a remarkable material, despite its apparent failure in the Bobbi machines. Conolon was initially developed for use in aircraft work by Dr. G. G. Havens, G. A. Gordon, and R. D. Ford. It might be called a by-product of the Metlbond high-strength adhesives developed by these same men, since it is made by impregnating fibers (especially Fiberglas) with a Metlbond resin and molding with heat and low pressure. Its maximum physical properties include:

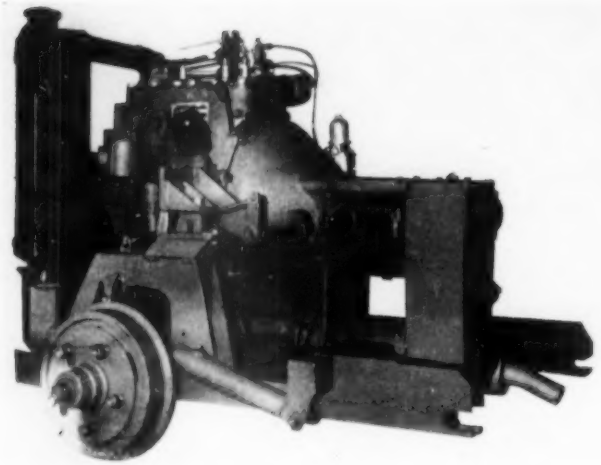
Modulus of elasticity	4.7×10^6
Tensile strength	120,000 psi
Compressive strength	56,000 psi
Specific gravity	1.64
Chemical resistance	Very good
Rockwell hardness (M-scale)	110
Edgewise impact resistance	126 ft. lbs./in.^{2}



Small delivery wagon scheduled to have Conolon body at the time it was developed by Bobbi Motor Car Corp'n, San Diego, California.

Here is one of Bobbi Motor Car Corporation's first designs for a plastic-bodied automobile. However, if it should go into production now, the body would most likely be made from metal.

This is Bobbi Motor Car Corporation's design for a sedan, body of which was originally supposed to be made by molding the Fiberglas laminate called "Conolon."



Pictured here is the lightweight power plant, on which Bobbi Motor Car Corporation's first automobile designs were based. Although it develops only 25 horsepower, it would have driven a small plastic-bodied automobile at a top speed of about 60 miles per hour.

Ultimate bearing strength	82,000 psi
Resistance to vibrations	Indefinitely high
Normal color	Orange
Finish	Smooth, glassy

These properties indicate the following advantages:

(1) Less weight than most aluminum alloys.

(2) Strength properties which would meet specifications for many steels.

(3) Better elasticity and vibration resistance than can be claimed for metals now on the market.

Unfortunately, Conolon presents a number of fabrication problems which can seriously hinder an automotive production program, even though they may not be insurmountable.

First of all, it must be remembered that thermosetting plastic resins cannot usually be stored for long periods of time without at least partially polymerizing and becoming unusuable—all of which means that the Bobbi-car plant would have probably needed extensive refrigerated storage space in order to maintain an adequate resin backlog. Then, there is the matter of impregnating Fiberglas or some other fabric with the resin—an essential process that would be simple enough, if it did not have to be followed by a drying period of 24 hours in open air, or 20 minutes in an oven set for a temperature of 140°F. During the drying period, the resin-impregnated fabric must be suspended so that it will not wrinkle, sag, or be subjected to dust or moisture—thus necessitating the use of many special fixtures in addition to a ventilated air-drying room or large low-temperature ovens.

When the drying period has ended, the fabric must be stored in a sealed container at approximately 75°F. until the time comes for it to be molded. It should never be stored for more than 30 days prior to use or exposed to temperatures of more than 75°F. Besides requiring additional storage facilities, this means the manufacturer must compute his production material requirements not more than three weeks in advance, being careful to avoid large surpluses which cannot be auctioned off or held for future use.

The laminating and molding of Conolon is not a hard job, but it necessitates the use of well-trained intelligent personnel. Careless mistakes in building up uni-directional fabric layers or in regulating molding temperatures can cause many rejections—or, worse still, defective parts that cannot be detected by ordinary inspection methods.

Compared with the tooling normally required to fabricate metals, the molds used in forming Conolon laminates are remarkable for design simplicity and low cost. Progressive forming is unnecessary, regardless of the shape to be formed, and expensive mold materials do not have to be utilized because the molds will never be subjected to pressures of more than 15 psi, or temperatures greater than 325°F. But, in making large automobile parts, there is always a possibility that each new mold will require a special vacuum-bag or hydropress design in order to attain desired temperatures and pressures over large areas simultaneously. This would make it difficult to standardize shop equipment.

If Conolon could be handled without too much special equipment or without skilled shop personnel, it could be used to make finished automobile parts for only about 25 per cent of what identical metal parts would cost—since each would — except for minor trimming operations — be ready for use as soon as it is removed from the vacuum bag or hydropress. Moreover, those parts would look good, have extreme durability in normal service conditions, and be economically repairable or replaceable when damaged by accidents. However, Conolon has not yet reached an appropriate

Here is the plastic-bodied Darrin automobile, as displayed to the public for the first time at the third annual Southern California Industrial Exposition, held last September in Los Angeles.

Plastic body parts of the first Darrin postwar automobile were made by manually applying resin-impregnated Fiberglas to molds of various shapes, as indicated here. The work took place at Industrial Plastics Corporation, Gardena, California.

stage of production perfection—possibly due to lack of attention on the part of good Tool Engineers.

At any rate, many of the objections to the use of Fiberglas laminates appear to have been overcome by Designer Howard Darrin in a new machine that was on exhibit for the first time at the Southern California Industrial Exposition in September. Darrin originally intended to produce his automobile at Grand Rapids, Michigan, but says now that his production program will begin in a new plant at Los Angeles.

Body for the prototype Darrin car, which was on display at the aforementioned exposition, was fabricated by Industrial Plastics Corporation at Gardena, Calif., a Los Angeles suburb. The work required about ten days of effort on the part of eight men, and necessitated approximately the following operations:

(1) The fabrication of two large plaster body molds from plaster mockups provided by Darrin. This took 8 days.

(2) The mixing of a resin with catalyst. The resin was a polyester combined with diallyl phthalate, and the catalyst was one of the so-called "sunshine-cure" compounds such as benzoyl peroxide. These materials have an indefinite bench life prior to mixing, and can be used for as many as 16 hours to impregnate fabric after mixing. The mixing was accomplished by heating the resin to about 110°F., the approximate temperature at which the catalyst melts, and stirring.

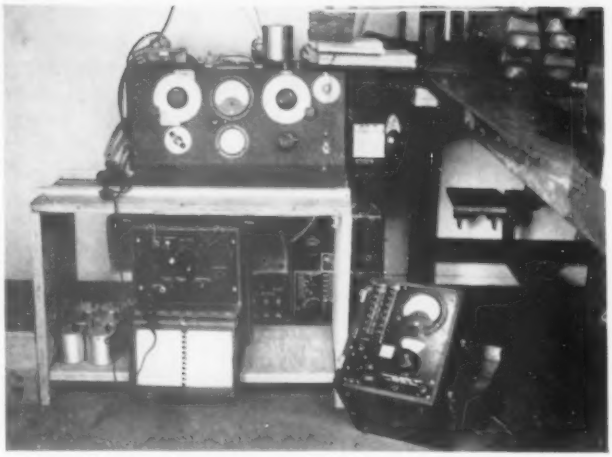
(3) The brushing of mixed resin into the Fiberglas ply. (Note: This did not have to be followed by a long drying period.)

(4) Positioning the sheets in layers on molds, and hand-pressing to the mold contours.

(5) Curing each layer for about 20 minutes in warm sunlight, then sanding and buffing the runs to provide even surfaces for the next ply. (Each layer was about .015" thick, and the four layers on each mold produced parts that were about .070" thick.)

(6) Routing out holes for lamps, locks, brackets, etc., with a band saw and trimming "flash" from the edges of each part.

Every layer of each laminated part in Darrin's plastic-bodied automobile had to be sanded and buffed, after curing for 20 minutes in open sunlight, as indicated here. If mass-production tooling had been available, each part might have been finished in six minutes.



Electronic curing or heating equipment, such as shown here, has done much to speed production of plastics in the past. Perhaps this is the sort of tooling that will make plastic-bodied automobiles practical.

(7) Coating the top layer or outside portion of each part with clear automobile lacquer. (Note: This is another operation that would not have been necessary in mass production, because the clear resin used to impregnate the Fiberglas could have been pigmented.)

According to W. B. Goldsworthy, President and Chief Engineer of the Industrial Plastics concern, the time required to produce individual sections of the Darrin car body can be reduced to about six minutes per section when high-speed plastic presses can be used in place of the sunlight and manual pressure described here.

Another innovation that may speed production would be a process whereby diallyl phthalate could be cured by itself in a reasonably-short time. As a previous article* recently suggested, diallyl phthalate is probably the best laminating resin now available; but, in making the prototype Darrin car, it had to be combined with a styrene polyester (Selectron 5003) in order to accomplish a reasonably-fast job.

Of course, all this does not mean that the plastic-bodied automobile has finally become practical; but, it does seem to indicate that great progress has been made, and that the final goal is near. Just now the major problem appears to be largely a matter of designing and fabricating tools that will be suitable for mass production.

*See "Report on Plastic Tooling" by the author, in October, 1946, *The Tool Engineer*.

Shown here are some of the presses normally used to compression-mold plastics and plastic laminates. Much larger machines, with better heating equipment and lower pressures, will probably be required to fabricate plastic automobile body parts in mass production.

By Georgia W. Leffingwell & Milton A. Lesser

Glycerine in Tool Engineering

Versatile and Widely Employed in Many Industries, Glycerine Has Become a "Tool" in Mass Production

THE EXTRAORDINARY variety of glycerine uses in metal treatments is due to the fact that this fluid provides an unusual combination of physical properties. Sometimes glycerine is employed because it provides but one desired characteristic, but in most instances a combination of various properties forms the basis of its utility.

It is because of these qualities that glycerine may be variously employed for such purposes as: (a) a humectant or hygroscopic agent, (b) a plasticizer, (c) a softening agent, (d) a solvent, (e) a vehicle or suspending agent, (f) a penetrant, (g) a lubricant, (h) an antifreeze, (i) a heat-transmitting medium, (j) a pressure-transmitting medium, (k) a chemically reactive substance, and a number of others.

Georgia W. Leffingwell **was graduated from Vassar College with degree M.A., with degree Ph.D. conferred by Columbia University. She is a Sutro Fellow in History; Editor of "Glycerine Facts," author of numerous articles published in trade and technical magazines and co-author of "Glycerine, Its Industrial and Commercial Applications."**

Glycerine's hygroscopic action, which is intimately associated with its plasticizing effects, is frequently employed in the preparation of molding and casting compositions. Mixed with clay, sand, or other materials, it combats excessive drying and through its ability to attract and retain moisture greatly facilitates the preparation and handling of molding materials.

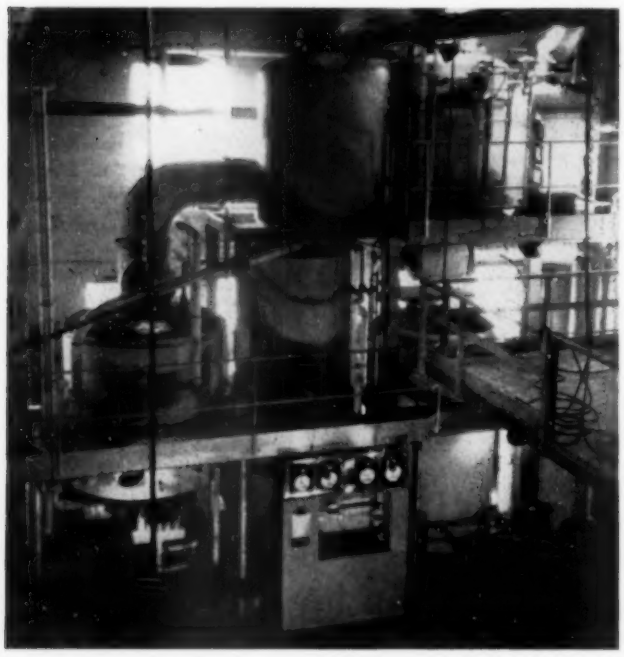
For example, to make products like "Plastecine," widely used in foundry work, clean, dry clay is mixed with enough glycerine to obtain a stiff, putty-like mass. This material will keep indefinitely, will not harden, and is always ready for use for modeling or for making glue molds. This is a marked advantage over water-bonded clays which must be kept in a humidor of some sort.

Glycerine is employed also as a hygroscopic bonding aid in the preparation of molding sands. An example of this use in precision casting is offered in the following formula:

Molder's sand (fine quality)	3 parts
Powdered clay	1 part
Glycerine	1 part
Water	2 parts

Milton A. Lesser **is a B.S. in Chemistry, College of the City of New York. He has been Research Assistant, Dep't of Surgery, New York University School of Medicine; technical editor, "Drug and Cosmetic Industry," and author of articles on glycerine and soaps in industry. He is a member of the American Chemical Society and the American Pharmaceutical Ass'n.**

Glycerine, fast becoming an important chemical, applicable to a host of industrial products, is produced in modern refining equipment as shown below.



Glycerine may also be used to advantage with synthetic molding sands. Although synthetic sand has greater durability than natural sand, it loses its moisture content much more rapidly. Hence, it is often advisable to add materials which will slow the drying and permit the molder to make any necessary patching and repairing. Glycerine has been tried for this purpose with good results.

For casting small parts where extremely fine detail is required, the use of a mixture of pumice and glycerine has been recommended. Casting is done in FFF pumice and glycerine mixed in an 8:1 ratio by volume. Aside from being extremely accurate for fine-detail casting, this mixture has two other definite advantages over regular foundry sand. First, it requires no parting sand, but breaks cleanly from the pattern and from itself. Second, it needs no tempering with water as does sand, hence no steam pits occur in the casting and there is no need to wait until too wet sand dries sufficiently. The pumice-glycerine mixture can be used repeatedly before renewal is necessary.

Following casting, stamping, or other shaping and forming operations, it is usually necessary to employ sanding, grinding, or polishing materials to remove excessive metal and impart a desired finish. Glycerine has long served in the manufacture of abrasive products required for such purposes. In the preparation of flexible, abrasive sheets, belts, or disks, it is used to plasticize the bonding agent holding the abrasive or to help maintain the flexibility of the paper or fabric supports.

On occasion, in the manufacture of ceramic-bonded abrasives, it is used for reasons similar to those for making molding materials. Here it facilitates the shaping and handling of the formed wheels; on firing, it volatizes off without leaving a residue. Of related interest is the suggestion, given in a patented method, for using the well-known glycerine-litharge cements as binders for abrasives to make finish-grinding and polishing stones.

Electrolytic methods have become important commercial processes for polishing and smoothing metals. Following H. H. Uhlig's fundamental work* which showed that glycerine-phosphoric acid baths provided superior electrolytic solutions for polishing stainless steel, glycerine has come to play an increasingly important role in this and related processes.

Electropolishing may be considered as the reverse of electroplating. In electroplating, the work is made the cathode and metal is added, while in electropolishing the work is made the anode and metal is removed. When the current is applied, a minute film on the surface is removed and flows into the electrolyte. The amount of metal removed in such an operation depends upon such factors as immersion time, current density, and to some extent on the condition of the surface.

Electropolishing Has Many Uses

The outstanding advantages of electropolishing are that it attains metal surfacing and imparts brilliant finishes without mechanical work being done on the metal. Such processes have proved valuable for processing surfaces so irregular in shape that mechanical methods of polishing are impractical, and sometimes almost impossible. The potentialities of such methods have been well indicated by C. L. Faust in the June 1946 issue, *Product Engineering*. He points out that, aside from providing bright, mirror-like finishes for metal articles, the electropolishing process is replacing automatic and hand operated mechanical equipment for machining parts to size, for removing burrs from stamped, ground, punched, drilled, and other machined edges, and for getting surfaces ready for final finishing by electroplating, painting, lacquering, japanning, and anodizing.

A patented process, which embodies many of these newer applications, calls for a glycerine-hydrochloric acid electrolyte to achieve the desired results. With such a solution, it is possible not only to polish metals electrolytically but also to size manufactured metal products accurately, to remove burrs and machine marks, to brighten and smooth metals so that they meet specification tolerances, and to remove metal symmetrically from ordinarily inaccessible parts while simultaneously brightening the metal surface. The object to be treated is employed as a cathode in an electrolytic solution consisting preferably of 25 per cent commercial hydrochloric acid and 75 per cent of glycerine, by volume.

From work done with the original glycerine-phosphoric acid solution it would seem that glycerine has at least two important functions in polishing electrolytes. One effect is a change in the electrolyte and anode film conductivity to produce optimum polish. A further useful effect is that the glycerine also inhibits direct attack of the electrolyte on the anode surface, preventing localized pickling of the anode by the acid. Uhlig's observation that optimum polishing effects were achieved with the glycerine-phosphoric acid bath has been confirmed by others. S. Wernick, for example, has pointed out in several articles that this electrolyte consistently produced a superior degree of polish over that obtained with baths based on sulfuric acid.

Aside from its value in phosphoric and hydrochloric acids-based solutions, glycerine has found a similarly useful role as an additional agent in other types of electropolishing baths. Among these may be mentioned a sulfuric acid-glycerine-water solution used in the electropolishing of German silver or iron or nickel or their alloys. Another glycerine containing sulfuric acid bath has been successfully employed in anodic polishing of aluminum. A hydroflouric acid-glycerine bath has been recommended for electrolytically brightening aluminum-silicon alloys.

Since electroplating is often employed in tool manufacture, it is noteworthy that electropolishing is a most valuable adjunct to electro-deposition procedures. In its roles as a finishing tool—as pointed out by Faust—electropolishing holds considerable interest to designers and engineers, especially where heavy plate is to be applied for engineering or mechanical reasons rather than for decorative or protective purposes.

A. Bregman (*Iron Age*, January 9th, 1941) has also remarked that electropolishing, as part of the electroplating procedure, has many highly efficient applications. The ability to perform multiple polishing and plating operations with the work on the same rack from start to finish offers many obvious advantages. Thus, after electropolishing, the work needs only rinsing to be ready for the plating operation.

Glycerine and Other Metals

Glycerine is useful in nickel plating baths, in cadmium plating, and in the electro-deposition of tungsten alloys, manganese, and molybdenum compounds. Glycerine may be used also, according to a foreign patent, in electroplating iron with chromium, nickel, tin, or various other metals.

Because the tempering of steel is an important consideration in tool making, it should be noted that glycerine and its aqueous solutions form excellent steel-quenching media. Investigations have shown that mixtures of glycerine and water are suitable for quenching in the region between oil quenching and water quenching. As noted by E. T. Richards (*Tech. Zent. prac. Metallbearbeit*, 1940), the higher the ratio of glycerine to water the milder becomes the quenching. When used to bridge the gap between oil and water, no dirt or deposits are formed on the metal, and traces of glycerine can easily be washed off.

Of interest, in this connection, is a patented process for making fine-edged tools in which a paste of stannic oxide in glycerine is recommended to protect certain areas from warping during hardening by nitriding with ammonia gas at high temperatures.

Glycerine is a standard ingredient of many types of soldering fluids, including various general-purpose and specialized products. Soldering pastes, which facilitate soldering by combining the solder and flux in one preparation, often contain substantial proportions of glycerine. Such pastes are said to be very satisfactory in practical use.

*Trans. Elektrochemical Soc'y, 1940.

Sample of alkyd resin, a reaction product of glycerine, phthalic anhydrite and suitable modifying agents. Widely adaptable to coating and finishing products.

By James Walker

Drawing Die Problems and Formulae

A Comprehensive Treatise Covering Advanced Design and Construction Of Simple and Compound Drawing Dies for the Mass Production Industry

Installment No. 1 of a Series

THE FOLLOWING SERIES of articles is intended for those in industry who are interested in the design, construction and adaptation of drawing problems and methods of coping with them. It is the writer's intention to present the information, data and formulae in such a manner that it will be easily understood by apprentice mechanics, designers and junior engineers who have had some basic knowledge of simply constructed dies.

James Walker **of Fort Worth, Texas, has a background of 20 years practical experience as a tool and die maker, and was successively foreman at Houston Pattern & Model Co.; general foreman of the tool and die dep't at Southern Aircraft Corp'n; and Chief Tool Engineer at Frazer Engineering Co., Dallas. Later, joining Consolidated Vultee Aircraft Corp'n, Ft. Worth, Texas, he served as Supervisor of Tool Design, and Tool Research Analyst. He is co-author, with Carl C. Taylor, of a 235-page book, "Simplified Punch and Diemaking," published in '46 by The Macmillan Company. Mr. Walker is also currently Ch'man of the A.S.T.E. Standards Committee, North Texas Chapter.**

Unless a person is familiar with the design, construction, or operation of simple cutting dies, he should study one of these phases of tooling before attempting to cope with the articles to follow. The articles will contain such information on the construction of intricate cutting dies, forming, curling and ironing operations, as may be deemed valuable.

However, they will deal more generally with drawing problems, the proper selection of tool steel, correct lubrication (drawing compounds), various methods of mounting, selection of press, press speeds and blank-holding pressures, all of which are equally important when one is confronted with a drawing problem.

Where these articles begin with the actual design of the dies, the method of approach relative to the construction of the dies will be fully detailed and discussed from a practical standpoint. So much depends on the correct amount of "beefing-up" on certain tools, that the construction is of paramount importance. Too often, dies will "open up" causing excessive clearances due to the lack of a sufficient number of screws and dowels, or to weak construction.

Accurate means of location is seldom taken into consideration when dies are being designed; in other words, a die that is constructed to blank or draw large quantities, or a standard tool that is set up to blank or draw small quantities which are set up repeatedly at short intervals must be of a sturdy construction, and also must be mounted in such a way as to provide ease in alignment after re-grinds and re-works, or if necessary in the case of an accident, assure ease in the replacing of a component part. New findings relative to precision mounting will be incorporated later on in this series.

Some Basic Considerations

To clarify the term "drawing" for those who are unfamiliar with it, let us suppose we have a flat disc, .062" x 5" diameter, and that, by a series of one or more operations, we force it into a cylindrical cavity of the required shape, the operation is known as a drawing operation. The first of a series of drawing operations is known as a preliminary draw, and is usually termed a "cupping operation."

The part thus formed is known as a "cup," and the subsequent draws or drawing operations are known as "re-draws" or "stages." There is a wide variety of stages, some of them being re-drawing, reducing, heading, ironing, coining, swaging, curling, annealing and pickling. Others will be discussed in other installments to follow.

Years ago, when one was confronted with a problem in drawing, the usual procedure was to ask someone familiar with this type of work whether or not he thought the part could be produced in one or more stages, or whether in his opinion, the part could be produced at all. The "expert" who was broadly experienced, would voice an opinion based upon his recollections of how the material to be drawn had behaved during somewhat similar operations. And even today, many shops rely on a few practical people, and not on engineers, for the proper design of dies, especially draw dies.

An increasing amount of data becomes available yearly, and is offered in the form of pamphlets, articles in magazines and books for those interested in the fabrication of sheet metal; however, the drawing of metals is an art still in its infancy. For instance, there are presses today which operate at thousands of tons pressure, a fact which was unbelievable years ago.

Also unbelievable are the reductions that are now possible due to new discoveries, such as dies which operate with water in place of a punch. The developments of drawing operations involving the hot and cold working of metal from flat blanks into the required cups, pans, shells, boxes, pails and numerous shapes, is second only in the breadth of application to the blanking and cutting operations.

Cooperative Effort Essential

It is essential that the skill of the designer, engineer, tool and die foreman, press room foreman and the metallurgist be combined as much as possible in order to obtain good parts. In other words, pure theoretical knowledge minus practical knowledge, or visa versa is not sufficient to execute a difficult drawing operation.

It is also possible for one to be an excellent diemaker or designer of dies—such as progressive blank and piercing,

In this installment, which is the first of a series and mainly introductory, the author presents the case for drawing dies and their application. Hence, all illustrations are omitted. However, the following installments will be profusely illustrated and, since a complete file will be useful for reference, readers who are interested in die design are urged to preserve and file each article as it appears.

The Editors.

forming and simple draw dies—and yet, when the problem arises, be incapable of designing or constructing a three or more stage drawing die. Those who are unfamiliar with draw work that requires three or more stages may question the preceding statement. It is emphasized that scientific data and formulae, metallurgy and tool and press room experience must be combined economically for best results.

There are many intricate shapes to be drawn, that require a high grade material and the best and most suitable lubricant, and a special die steel for constructing the dies. It is also possible to have available experienced engineers, high grade mechanics, metallurgists, good press men and excellent material, and still encounter months of difficulty when faced with the problem of drawing an article of intricate contour. Proof of the preceding statement will be clarified in later chapters; i.e., a part where nineteen stages were required to complete it; another where production was stepped up from 50,000 pieces to 8,000,000 without re-work to the tools —these are only two of the many examples which will be described later.

Diameters and Depths

The ratio between the diameters and the depth of drawn shells differs widely, and this ratio is an important factor in the design of any draw die. It is significant that changing a flat blank into the form of a shallow cup is less of an engineering problem than changing the same flat blank into the form of a deep shell, and naturally, the smaller the diameter in proportion to its depth, the more difficult the operation will be.

Additional factors to be considered are the kind of material to be used, its thickness, ductility, elongation, compression, and strength for resisting strain. Since there are so many factors that must be considered in the design of drawing dies, it becomes evident that more complex dies cannot be fully determined by any set rules or formulae. Some of the data and formulae that will be offered will be theoretically accurate; others are empirical or approximations sufficiently close for an engineering start.

It is possible to have a set of well constructed drawing dies producing excellent parts, then, on the arrival of a new shipment of material, to have these tools fail because of an inferior alloy in the material. This statement, however, will be qualified in the following paragraphs since, frequently, the question of fractured shells or cups will arise; that is, the case of a cup or shell that tears or ruptures during any of the stages of drawing.

This fracture may be attributed, by the consumer, to one or more factors. One of the natural impulses, when confronted with the above difficulty or other difficulties, is to place the blame on the material; something or someone has to be the "fall guy," and the material is usually criticized first. Actually, a great percentage of the blame should fall on the consumer's shoulders and not on the rolling mills.

High Material Demands

Increasing demands are being made today of the material, some of them being higher press speeds, fewer operations to obtain a greater depth of draw, more intricate shapes to contend with, less inter-stage annealing, smoother finish, wall thickness held to a minimum tolerance and the unending attempts on the part of the consumer to reduce his own production costs and, at the same time, to decrease the grades in the qualities of the sheet material.

Any manufacturer will, of course, try to produce an article in the minimum stages. However, since the cost of the material itself often exceeds the costs of the tools and production, a spoilage of expensive material can mean failure of a business. It is evident, then, that the material purchased should have a safety margin, thus extending a slight variation which is bound to occur in the manufacture of the sheet metal. It is also good judgment to add an operation, when in doubt, rather than attempt to cut down on the operations. This oftentimes will eliminate costly "headaches."

Blanking Operation Fundamentals

A blanking operation is usually the first stage of a series, and is so simple an operation that it is very seldom given sufficient consideration, and in many instances failures incurred later on can be attributed to dulled edges of the dies, or dies that have excessive clearances. Burrs that remain on the blanked parts are usually caused by incorrect clearances of the blanking dies or by tools that are in poor condition.

When these burred parts go unnoticed and are fed to the dies, obviously, the pressure ring will be prevented from exerting its full degree of holding power. Then, as the punch descends, the blank will be forced between the punch and die, the burred edge drags its way across the pressure ring and the faces of the draw die, causing scratches to occur upon these holding members.

As the blank is forced between the punch and die, the burred portion tends to thicken most at the edges, thus work-hardening. When work-hardening occurs at the edges of the cup, it will naturally tend to tear in the cupping operation, or the operations to follow. Obviously, the continued dragging of the burred edges finally "galls" the faces of both the pressure ring and the die face, resulting in "scored parts," another factor to which ruptures are attributable.

Variable Factors Must be Reconciled

Insufficient harmony between the press room and the tool room, tool room and designing, designing and engineering, or a combination of any of the departments mentioned, is responsible for a great percentage of failures in the shops today. The continued practice of "passing the buck" should be discouraged. It is foolish for anyone to expect a die to produce a passable part at the first setting or at any interval setting later on, because there are so many variable factors that govern the success of a die.

Among these may be mentioned the drawing compound, press speed, excessive or inexcessive pressure on the pressure ring, burrs, material, high spots, and the contour of the blank. Often, a little patience on the part of an experienced press operator and his supervisor will aid in the success of a die simply by the trial and error method. Problems will arise more frequently in the drawing of a rectangular or unsymmetrical shape than in a symmetrical or cylindrical shape.

In the case of a rectangular drawn part, it is possible to have an excellent die, correct compound, press speed and pressure ring pressure, yet be unable to acquire a part due to the incorrect contour of the blank, especially at the corners. Trimming the material across the corners of a blank will eliminate excessive gripping and will help prevent wrinkles and rupture.

When the correct flat layout is finally created by the trial and error method, a templet should be made *then*, to insure the exact duplication for the production runs to follow. Failures will be encountered in any shop, particularly during drawing operations. Most shops of today lack the skill of the die setters of the past, who were able to recollect and remedy the discrepancies that confronted them.

Much better design, however, is available, today, due to the collaborated experiences of the metallurgists, designers, engineers and the practical men who have presented much information; although, as previously stated, the art of sheet metal fabrication is still very young. It is not the intention of the writer to place the blame on any one department, but to point out that success or failure depends upon the harmony of all departments, as departmental friction and the "that won't work" attitude will certainly retard progress.

Handling the Material

Lack of economical methods in handling materials and tools is a significant factor in increasing the manufacturing costs. Many shops, today, lack the proper equipment and experience that is required to achieve high production. First, it is possible to have high grade tooling that is capable of supplying high production, and the shop be so lacking in efficient equipment, that the down-time between operations requires a great percentage of a work-day.

Second, many shops that do not have a railroad siding require the material to be trucked to their warehouse and stored, then trucked to the shears for shearing, and finally trucked to the work station. It can be readily seen that the truck time from the railroad siding to the warehouse, to the shears, and to the work station can exceed the time required by high production dies to produce the articles themselves.

Third, equipment for trucking the dies from the tool room to the work station for tryout, or from the tool crib to the work station, or changes during the actual operations is doubly important in ensuring a low production figure. Too many shops have nothing available but the common "dolly," for plant transportation, which requires two to four men (sometimes they are diemakers, drawing high wages) to lug the dies to the work stations for trials, or crib attendants and press operators to truck the dies to the work stations. This is an expensive procedure, whereas purchase of a motored vehicle and rail cranes would probably pay for themselves in a short time.

Plant Layout Vital

Fourth, it is also possible to have a well equipped shop fail to reach high production because of poor pressroom layout. For example, having sheets located remote from work stations, or presses staggered at various angles (supposedly for the handling of long sheets) which hinder rather than help, hand or conveyor handling because of the "staggering" in the wrong direction. The practical man's advice should be solicited, particularly during pressroom layout, and also during difficult press operations. His ideas should also be solicited during design, press setup and during construction of the tools themselves, as he will notice defects more quickly because of his many years of experience.

Conclusion of Introduction

In concluding this introduction, we will briefly describe tools that have proven their worth in production, and relate some of the failures encountered and the methods that were used to eliminate them. For instance, the "cheapest tool" is not always the cheapest—i.e., sometimes a progressive die of three or more stages would be less practical than three separate dies, or two dies and a single die.

High production warrants a progressive die more than low production, because the initial cost would be consumed in a very short time, also because of the fact that fewer presses would be needed, hence, fewer operators. One other important factor to keep in mind, relative to progressive dies, is that dies which blank, pierce, form and shave, or dies that blank, pierce, draw and trim, or any die that requires three or more stages, should not be attempted by the novice.

So many things affect progressive dies. For example, the shut-height which governs all operations simultaneously, the re-grinds to the blank die which must be considered—and, at the same time, provision which must be allowed for the adjustment to the forming die which, in turn, usually governs the shut-height of all stages that are mounted on one die set. Also, a certain amount of elongation must be allowed for the correct contour of the part formed—that is to say, spring-back of the finished part must be allowed for, as a shift might be prevented later, due to all stations touching one another. Automatic stops must also be provided at the various stages, such as a stop at the first station, and positive stops at the stations to follow, so as to provide ease in actual operation.

All of the above factors are interdependent and all are important. Without an abundance of experience in less complicated dies, the progressive type of die should be avoided.

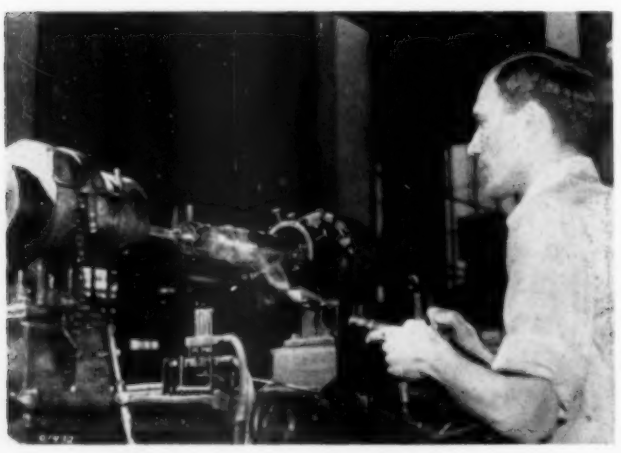
A Few Novel Operations

As previously stated, simply constructed dies will be ignored in these articles, and anyone desirous of such information is urged to study, "Simplified Punch and Diemaking" —*Macmillan*, 1946, or any other book or article relative to the basic fundamentals of diemaking.

End of Part 1. Installment No. 2, this series, will follow in May, The Tool Engineer.

Peacetime "Flame Thrower"

AN INTERESTING APPLICATION of heat is illustrated here, where William Zidlick wields a torrid gas jet at the Mount Vernon (N. Y.) plant of the North American Philips Company, Inc. As shown, he is "sealing in" a rotating-anode X-ray tube. The anode and cathode, in two separate glass assemblies, are joined together. The delicate operation is facilitated by a special lathe in which headstock and tailstock are synchronized and therefore run in unison.



Airplane Fault Detector

OF INTEREST to our air minded Tool Engineers is an invention which will greatly increase safety in the air. Developed in Sweden and currently in use on the Swedish Aerotransport, and other Swedish airlines, including the Inter-Continental, the device—which costs about $25 per engine—has been proven, by exhaustive tests, to unfailingly discover the majority of engine troubles long before ordinary instruments show any reaction.

Engine trouble, according to H. Hanson, chief engineer of Aerotransport, does not develop instantly. Before damage becomes so serious that engine failure occurs, a series of minor symptoms appear. In every case of overheating, or of damage to bearings or pistons, small metal particles are loosened and float away with the oil until they reach the pump.

The new "fault detector" consists of a small steel pin enclosed in a metal cartridge. This is placed in the oil pump, and both the pin and the cartridge are connected to the battery. If metal particles follow the oil to the pump, they are caught in the narrow passage between the pin and the cartridge and produce a contact between the two. This, in turn, closes the current and lights a warning bulb on the instrument panel, and the pilot can shut off the failing engine before further damage occurs.

Courtesy of American-Swedish News Exchange, Inc.

By Scrivener Engineering Staff

Centerless Grinding of Plastic Parts

Improved British Automatic Cycle Machine Produces 800 Fountain Pen Barrels Per Hour

THE FOUNTAIN PEN TRADE is a branch of the plastics industry in which profitable business, in normal times, is only possible by utilizing every device for rapid and low-cost production which the skill and ingenuity of the Tool Engineer has made available. Not many years ago, Italian makers in the line were finishing pen barrels by diamond turning with a production of some 12 barrels per hour per machine.

The amount of development work which has been done in the interval can be gauged from the fact that, today, work is being finished upon Scrivener automatic controlled cycle centerless grinders with a production of some 800 finish-ground barrels per hour per machine.

The principle of the centerless grinding process is shown by the diagram, Fig. 2, from which it will be seen that the part to be ground is placed upon a supporting workplate between a small control wheel and a larger grinding wheel. By lateral movement of the control wheel, the work is then advanced on to the grinding wheel, and when the grinding operation is finished the wheels again open and the piece is ejected.

Automatic Feed and Control

In a modern centerless grinder—such as the Scrivener controlled cycle machine—the work is fed on to the workplate automatically from a magazine, and the control wheel also advances the piece automatically on to the grinding wheel. Wheel advance, magazine feed, and ejector are so linked up and synchronized that the function of the operator is merely to keep the magazine supplied with blanks. The process is used for grinding barrels, caps, and pen sections—different widths of wheel being required for each part as shown by Fig. 3.

This account of fountain pen manufacture in England, using a machine of British development, should be of particular interest to American Tool Engineers inasmuch as it suggests broadening applications of centerless grinding. This article is contributed by the Engineering Staff of Arthur Scrivener, Ltd., Tyburn Road, Birmingham, England.

The Editors

FIG. 1. Barrels, caps, and pen sections ground by the centerless process.

The fullest advantage of this interesting development is secured in those plants where the production is sufficiently large to justify the installation of three separate automatic machines which can be kept permanently set up with wheels and magazines. As for example, one for grinding the barrels, another for caps, and another for pen sections. Such a battery of machines would produce each of these parts at the rate of 800 per hour net.

Smaller makers would necessarily be content with a single machine which would first have to be set up with wheels and magazines for producing, say 25,000 barrels, after which different wheels and magazines would have to be substituted for grinding the same quantity of caps, and the work of changing the setup would therefore entail a loss of somewhat over half a day's production. After a similar quantity of caps had been ground, it would then be necessary to make another change-over for the pen sections, with a similar loss of time and production in the process.

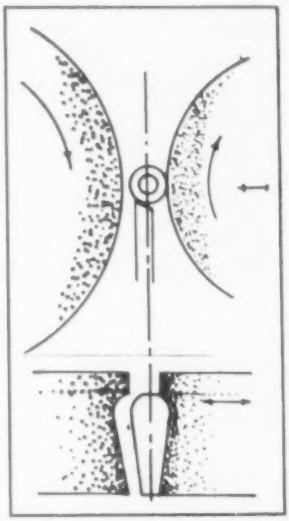


FIG. 2. The principle of the centerless grinding process.

Stock Removal

The stock removal in grinding fountain pen parts—and plastics generally—is heavy, compared with what is usual in the engineering industry, being usually in the neighborhood of .030", and the finish required is also of an extremely high order, being specified as soft and silky to the touch. These requirements presuppose the employment, not only of a substantially built centerless machine with very rigid spindle and bearings, but also of specially selected wheels.

The limits of accuracy specified in the trade, while reasonably close, are not so exacting as those demanded from centerless machines required for grinding such an engineering component as a diesel engine injection needle, for instance, where the limits for size are plus-minus .00005" on diameter, with a surface finish of 3-4 micro inches.

FIG. 4, at RIGHT. This form would entail excessive wheel breakdown at point "a."

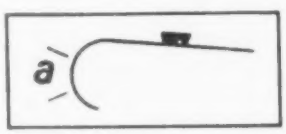
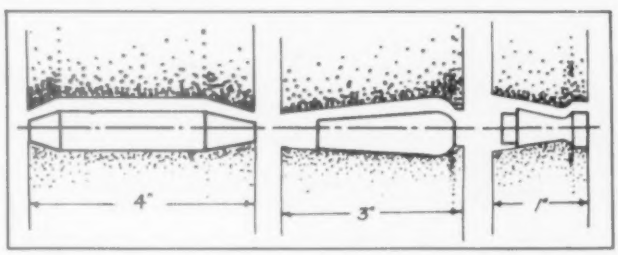


FIG. 3, BELOW. Barrel, cap, and pen section each require different widths of wheel.



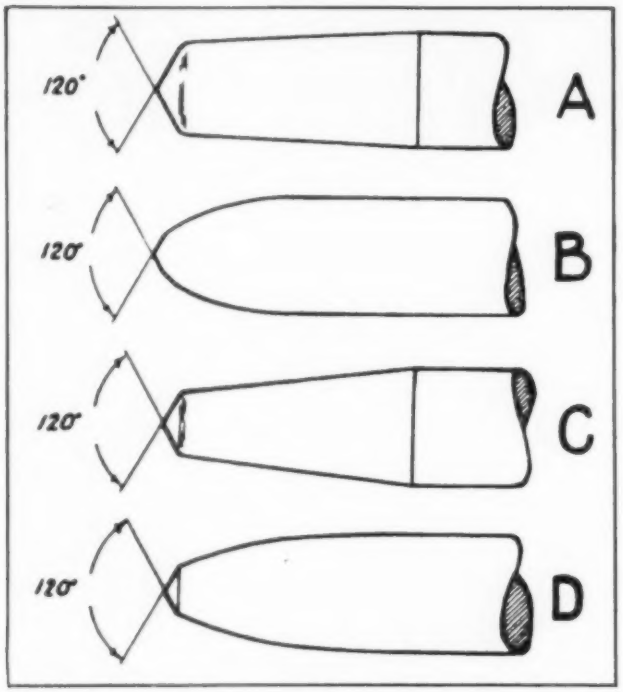


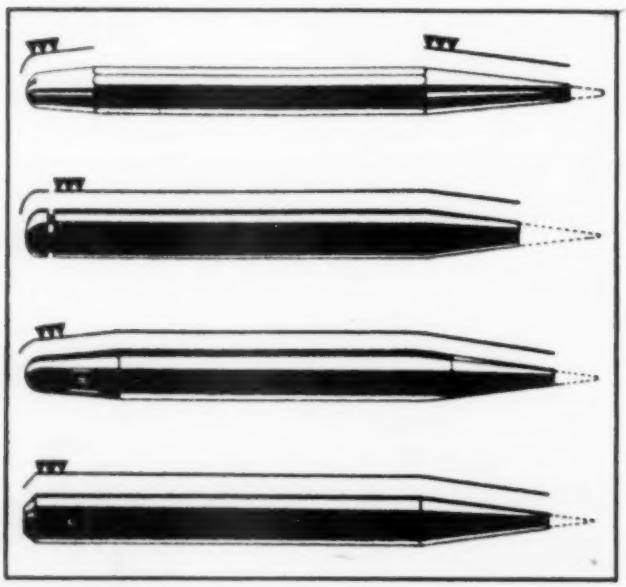
FIG. 5. Various attractive end forms which can be ground by centerless.

Limitations of Process

In the design of pen or other plastic parts which are intended for centerless grinding, it has to be borne in mind that the wheel of a centerless grinder cannot grind a full half radius at the end of a cylindrical piece in the manner shown by Fig. 4, as the wheel at point "a" would break down too quickly for this to be a practicable proposition. The nearest advisable approach to this form would therefore be an angular or domed end with a final included angle of 120 degrees. Fig. 5 shows four attractive alternative forms for caps or barrel ends.

Another point which has to be borne in mind in connection with the older type of manually-operated centerless machine, employing a hand lever for advancing the control wheel and work on to the grinding wheel, is that this method (which gives a partial turn to the lead screw) is only capable of advancing the wheel by some 1/16".

FIG. 7. Stylographic pens and pencils centerless ground.



If the depth of form on the work exceeds 1/16", then it is not possible to eject the piece automatically, as will be seen by reference to Fig. 6. In the Scrivener controlled cycle machine, in addition to this advance being made automatically by hydraulic means, the amount of such advance can be any amount up to 1", which makes it possible to grind, and also eject deeply formed pieces which could not have been handled by the process before the development of this feature.

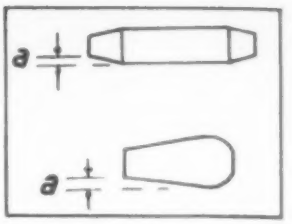


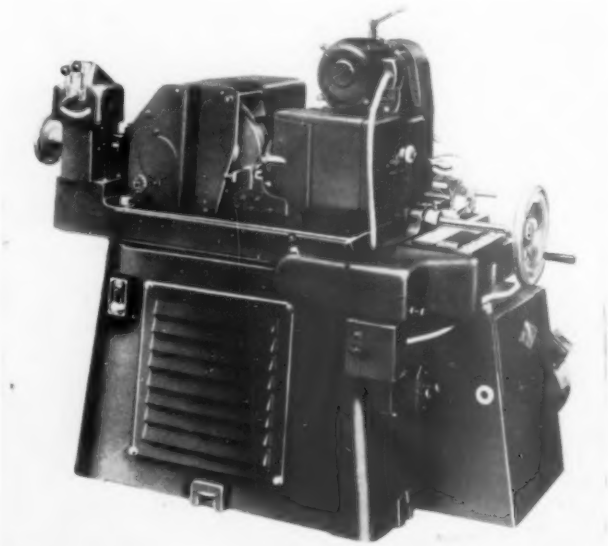
FIG. 6. Depth of form must not exceed amount of wheel advance if piece is to be ejected.

Stylographic

Although, in the foregoing description, mention has only been made of fountain pens, the centerless grinding process is equally applicable to the grinding of stylographic pencils and pens, such as are shown in Fig. 7, where the ground portions are indicated by the usual conventional grinding marks.

The same machine, when fitted with bar-grinding equipment also serves for grinding plastic materials in rod and tube form. In this process, the production of this modern machine is equally noteworthy, as it is possible to grind case in rod at rates up to 150 feet per minute in the smaller sizes.

FIG. 8. Scrivener No. 1 (patent) Controlled Cycle Centerless grinder, as used for pen manufacture.



Oil Dilution Calculator

PROPORTIONS OF CUTTING FLUIDS may now be computed, in a matter of seconds, with a simple pocket size new calculator, called the Dilut-O-Graph. Given the recommended proportions—as 1 to 5, 1 to 8, 1 to 30 and so on—for mixing or diluting oils, and the capacity of the tank, the Dilut-O-Graph shows the exact amount of base oil to use. Made of special board and measuring only 4½" in diameter, the calculator may be obtained free of charge by writing to D. A. Stuart Oil Company, 2727-49 S. Troy St., Chicago 23, Illinois.

By A. F. Davis

Arc Welding Speeds Rebuilding of Dies

BUILDING UP WORN SURFACES on forming dies by electric arc welding is a departure from the conventional methods in current use throughout industry. The successful introduction of this new procedure—that of depositing an electrode of metallic homogeneity on the worn face of the die—is conclusively proven by its adoption as the standard operating procedure at The Lincoln Electric Company, Cleveland, O., a leading manufacturer of electric arc welding equipment.

At the Lincoln plant, where speed and quality of production are of utmost importance, the issue of rebuilding dies used in the forming of truck handles (Fig. 1) for one of their 500-ampere electric arc welding machines was a barrier that retarded production. Made of hot rolled steel, these truck handles are formed with the scale still on them, resulting in an abnormal wear on the forming edges of the die. Consequently, a faster procedure was developed of building up these dies with an electrode which, in this case was "Abrasoweld"—an electrode especially developed and manufactured for building up straight carbon, low alloy or high manganese steels with a self-hardening deposit to resist abrasion and pronounced impact.

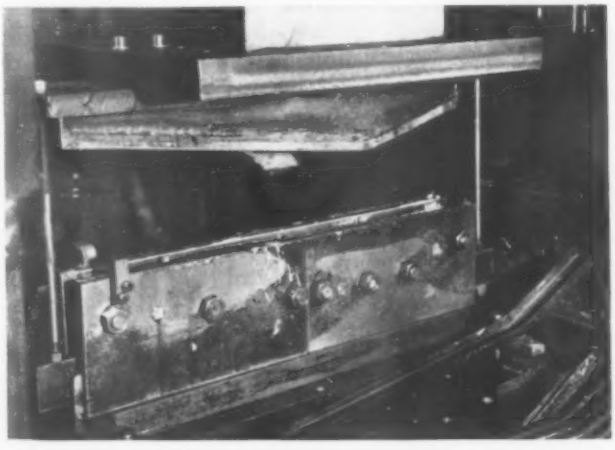
Preparing a die for rebuilding by welding is relatively simple. The worn surface is rough milled on a milling machine, with the die held in position by clamps. Then, to assure maximum success in the operation, the die is preheated to a temperature of 500° F., by light passes with an acetylene torch.

Long Beads Overlapped

Long beads, approximately ½ to ⅝ inches wide, are run into the worn areas and are closely overlapped so that a uniform ⅛ inch build-up is obtained in one pass. Each bead is immediately peened after application to increase its hardness, and the slag is thoroughly removed before the next bead is welded on the face of the die. When the desired height of the build-up on the worn area is achieved, it must be accurately ground down to the prescribed level by a surface grinder.

This new surface of "Abrasoweld" (Fig. 2) on the forming edge of the die is much harder—between 40 to 50 Rockwell—than the original forming edge, which was 10 to 20 mild steel, and is expected to last much longer due to its increased resistance to abrasion and impact.

FIG. 1. The dies in position, on the press, for forming the truck handles for a large electric arc welding machine manufactured by the Lincoln Electric Company.



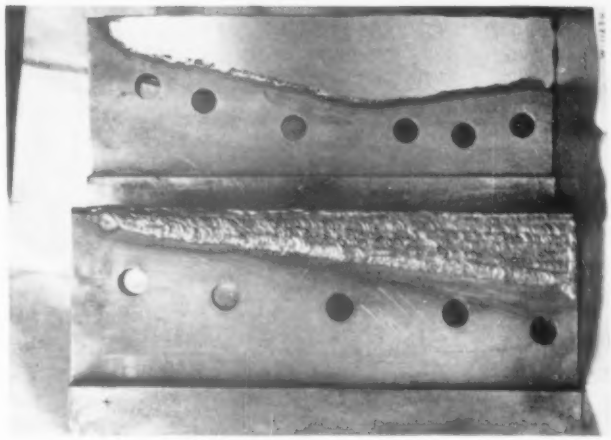


FIG. 2. Inner faces of dies after build-up with "Abrasoweld." The upper die has been ground, while the lower one is shown as built-up prior to grinding.

The conventional method of building-up this die would have been to accurately machine out the worn area and fit an insert plate of tool steel in the die. The cost of labor and materials for this insert procedure would have amounted to approximately $200.

On the other hand, building up the worn surfaces on the forming die by welding represents a saving of at least sixty per cent over conventional methods. The electrodes are less expensive than tool steel, and a welder's time on the job is considerably less than the time a machinist would spend in a similar operation. Time must be considered from another angle, too, as the actual welding procedure in getting these dies back into production is far less time consuming than the conventional method. As a result, each die rebuilt by welding resumes its role on the production line much sooner.

Prior to the new procedure of building-up dies, about 1,500 truck handles were formed on each die before the forming edges broke down. But now, more than twice that number can be turned out, or even more, before the die needs rebuilding.

New Anti-Corrosive Process

AN ANTI-CORROSIVE process, which is said to give 20 years protection to ferrous metals against all common corrosive forces, has latterly been introduced to domestic and world markets. Named "Zincilate," the process is a development of Industrial Metal Protectives, Inc., Dayton, Ohio. At time of writing, ten plants are being set up in key cities for its manufacture; of these, the Industrial Metal Protectives Corp'n of Virginia will be the initial producer.

Successfully tested under severe conditions, this "one coat" protective coating is said to be unaffected after 1000 hours exposure in standard salt fog corrosion equipment, as approved by the American Society for Testing Materials. The maximum Army and Navy specifications require only 200 hours.

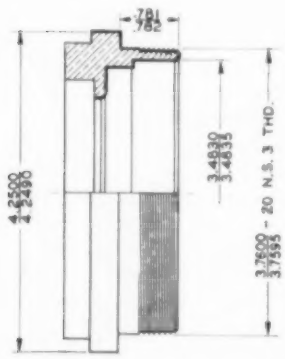
By Fred W. Steiner

Reviews and Previews

AMONG THE OUTSTANDING "Tools of Today," reviewed by our editors, is a new Multi-Operation Chucking Machine by Hardinge Brothers, Inc., Elmira, N. Y. The design of the machine was prompted by the wide acceptance of the Hardinge Second Operation Machine, which indicated a need for a precision chucking machine that would produce large diameter parts to an accuracy that, previously, had been associated only with small diameter work. So produced, the machine fills the gap between second operation work and large turret lathes.

The Hardinge Multi-Operation Chucking Machine is for turning, boring or threading parts, up to 6" in diameter, which have been previously blanked out in automatics, or for finishing stampings, castings, forgings or other parts that ordinarily require many setups. Typical examples are parts requiring threads to be cut concentric with turned or bored diameters, as well as square and true with shoulders.

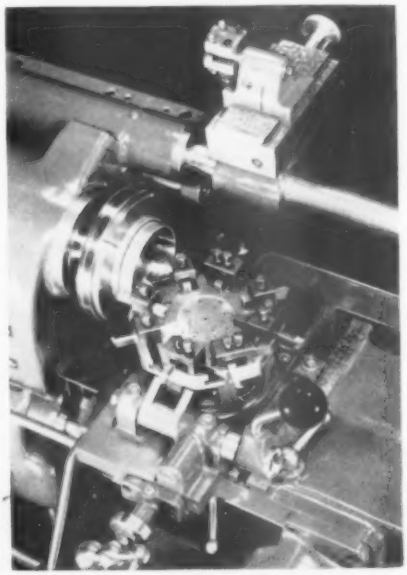
For such work, requiring fine finish, this machine seems ideally suited. An eight-position turret (as compared to a six-position) and a production threading head—both of which use standard tools, permit simple setups for low cost tooling and low setup costs for small lot production. The precision threading unit is separate—equivalent to adding a position for the turret for other tooling. Also, a pre-loaded ball bearing headstock, which affords maximum rigidity with a proper speed range, ideally suits the machine to precision boring.

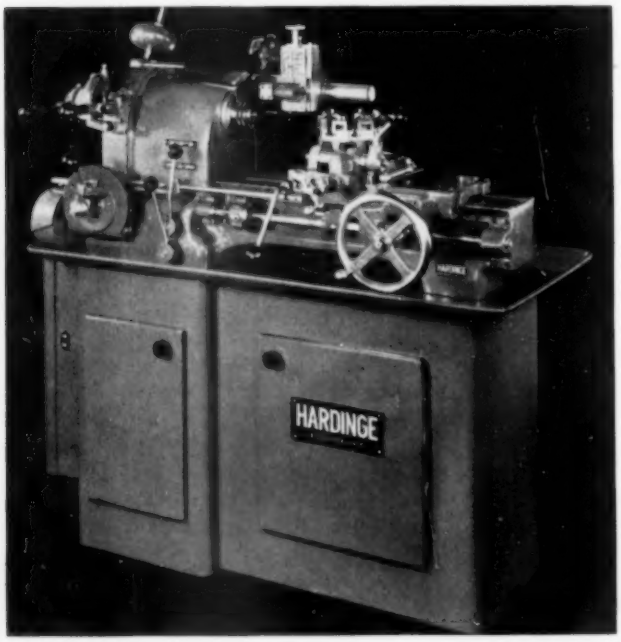


Described in brief detail, the headstock spindle, which takes 1" stock in standard 5C collets, has a speed range of 150 to 1500 rpm, forward or reverse. Step chucks provide collet-like chucking up to 6" diameter, while square or irregular shaped parts may be machined in jaw-type chucks.

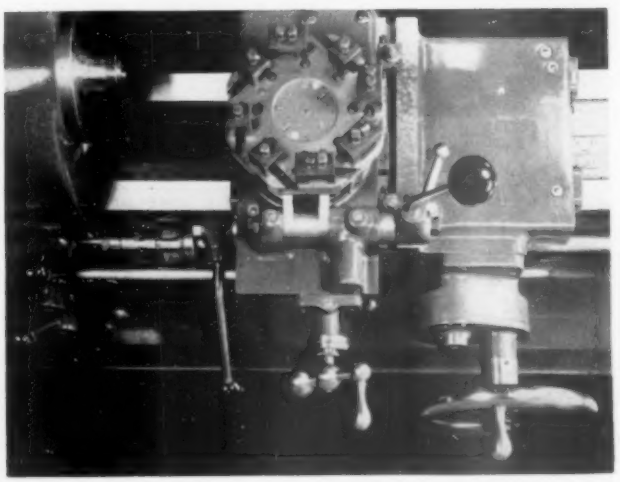
The production threading head is controlled by a master precision lead screw mounted directly on the rear of the tailstock spindle. Since there are no intervening gears, accurate duplication is assured. Threading speeds are unusually high—for example, 1½" - 20 threads are cut in steel at 500 rpm, while fine threads can be cut in 3" diameter aluminum at 1500 rpm. Threads can be cut within ½ turn from a shoulder.

The bed, of typical Hardinge design, has hardened and precision ground steel dovetail ways, while the carriage is of generous proportions yet providing the sensitive "feel" necessary for precision work. The turret has eight stations, with the desirable feature that each can be independently adjusted without affecting other stations. This built-in feature is novel with the Hardinge machine. The turret takes ⅜" square or ⅜" x ¾" rectangular tools directly on the hardened and ground steel surface, and it is possible to perform as many as twenty-four single point operations in one setup.





BELOW, front view of Hardinge Multi-Operation Chucking Machine. At LEFT, a typical part, the 12 surfaces of which are all finished with single point tools—conceded the most accurate method of finishing. At RIGHT, closeup of the machine turning a large diameter part —⅜" sq. tool bits used throughout. Standard step chucks and turret, close to the work, reduce tool spring and enhance accuracy.



BROWN & SHARPE MFG CO., Providence, R. I., offers a newly designed No. 2 Surface Grinding Machine that incorporates many improvements over previous models, together with selections of equipment to meet a wide variety of operating conditions. The machine is available with either a 1½ h.p. driving motor in the base, or with a 1 h.p. motor driving the spindle directly. The latter is known as the motorized spindle.

With the base mounted motor, the drive to table and spindle is provided through an endless belt concealed within the column, yet readily accessible for inspection or — should it be necessary—for belt removal. A weighted idler pulley, in the base of the machine provides proper belt tension. With the motorized spindle type, drive to the spindle is through a vibration-dampening coupling, while power feed for the table is by means of a ¼ h.p. motor in the base. Superficially, the machines are alike in appearance.

At LEFT, front view of Brown & Sharpe No. 2 Surface Grinding Machine. Note carefully designed guards and conveniently located controls. ABOVE, rear view of machine.

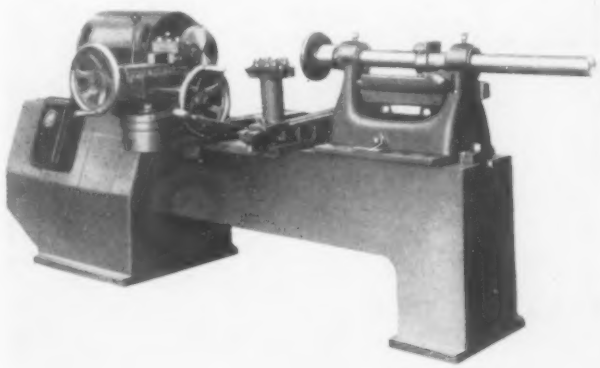
Two rates of table travel are provided: 19 ft., or 31 ft. per minute. The change in rate is effected through a convenient clutch lever at the front of the machine which permits an operator to readily change the travel rate to suit the work. The machine may be had with a close fitting plain bearing spindle, or with a permanently sealed grease lubricated anti-friction bearing spindle, both of cartridge type and interchangeable. Either provides an exceptional grinding finish with quick spark out, and the selection of type is entirely dependent on individual preference.

The new machine is heavier, with a larger column for increased rigidity. The electrical controls are housed in a separate compartment, sealed against entrance of foreign matter yet readily accessible. The safety handle is interlocked with a disconnect switch, and all electrical equipment is in accord with M. T. E. Standards. The machine is also available with hand feeds only (in the No. 2B Surface Grinding Machine) and, like the No. 2, with the same spindle options. Both machines grind work 18" long, 6" wide and 9½" high, using 7" diameter grinding wheels.

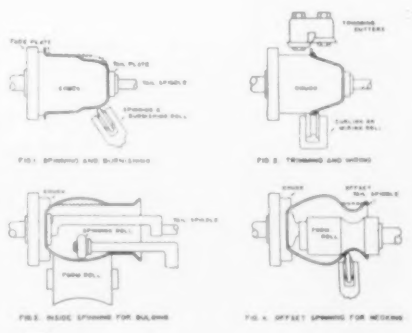
A NEW SECOND OPERATION spinning lathe, by the E. W. Bliss Company, Detroit, which is offered in two sizes, provides fast, light equipment to bulge, neck, bead, wire, flange, curl and trim a wide variety of drawn or spun shells. While not recommended as an alternative to the toggle press for producing shells from flat discs, these lathes readily accomplish secondary spinning operations on products previously drawn in presses, and at a rate commensurate with the primary operation. As such, they supplement the presses.

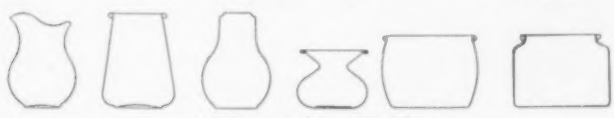
Use of welded steel construction for the frame, has enabled Bliss to install a fully enclosed, V-belt motor drive and gear box, without any increase in weight above that of the old machine furnished in bare style. A combination multi-disc friction clutch and brake insures instant stopping: this, together with a fast acting tailstock toggle clamp, permits rapid loading and unloading.

Headstock spindles run on Timken bearings at the following variable speeds: Model No. 15 at 275, 365, 615 and 1140 r.p.m., and model No. 16 at 180, 370, 675 and 1140 r.p.m. The lathes weigh 1500 and 3000 pounds respectively, and may be had up to 30" swing and 92" bed length. The tailstock offset adjustment allows use of inside form rolls to replace the slower and more expensive sectional chucks commonly used.

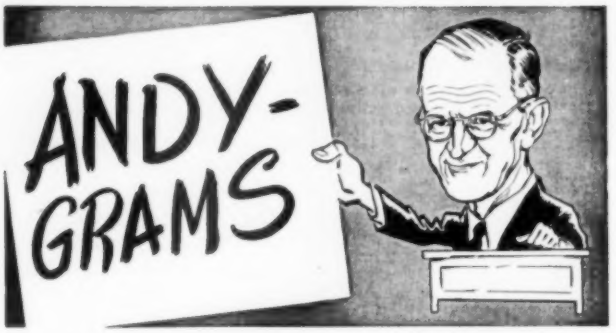


At LEFT, the new Bliss Spinning Lathe. At RIGHT, tooling used — as frictionless spinning tools and burnishing tools — in various spinning operations. BELOW, typical examples of shapes spun from straight shells.





A few shapes spun from straight shells.



NATURALLY, YOU BOYS North, East, West, South are agog for news of the doings at the Annual down in Houston, but, you'll just have to wait 'til next month. There'll be plenty by then—especially in the A.S.T.E. News. In this connection, Doris Pratt deserves a big hand for her pre-Convention "spread" in the February issue. Take a bow, Doris!

Of particular interest to the editorial staff, at this time—and no doubt to our readers as well—are the responses to the Questionnaire: "What I like to read in *The Tool Engineer.*" Checking through the first 180 returns, we find that 155 showed preference for new developments, as displayed in our editorial and advertising pages. While some of the returns were unsigned, the majority bore the signatures of key executives—the whole indicative of a keen interest in new equipment. Included were several complimentary comments on the way this equipment is displayed in *The Tool Engineer.*

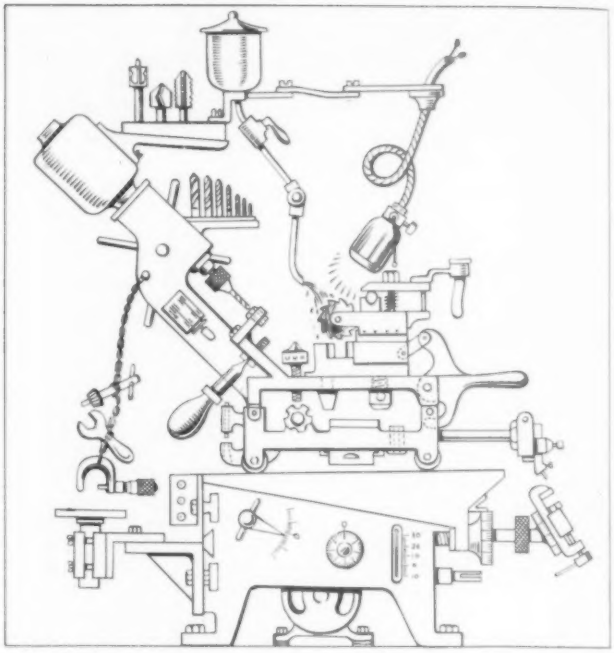
"Fundamentals of Tool Engineering" ran consistently in the first division, or 88%, as against 86% for new equipment. Here, the signers ranged from students to top executives, with the two extremes about equally represented. As for "special subjects," the returns give a good indication of what our readers want in the line of "know-how" although, in the main, we have either covered or have on tap articles requested. We just can't put everything into one book.

As for my "Andygrams," it seems that I'm losing my oomph, only about 55% having checked it off. One return said: "Cut it out, it's all very foolish." That return, however, was conspicuous because of derogatory criticism directed solely against one feature. But then, a number of others asked for more of the same, all of which goes to show that a bit o' foolishness is "relished by the best of men." So, until the Column nets more knocks than boosts, we'll carry on.

While several of the returns advanced constructive criticism (which will receive due consideration) the majority indicated marked satisfaction with format and presentation of articles. "Keep up the present high quality" . . . "I read it from cover to cover" . . . "authoritative and highly informative" . . . "easy to read" . . . "I file every copy," and so on and on. Yet, while all this is very encouraging, we are by no means resting on our laurels. Rather, we are consistently improving, and the best is yet to be. On behalf of the staff and the Editorial Com'tee, however, I want to express appreciation to those of our members who have taken the trouble to fill in and mail the Questionnaires. Thanks a lot!

Speaking of foolishness, I've had one of these "Gadgets" kicking around for some time without being able to find a home for it. So, we'll include it with some of the other nonsense that, from time to time, appears on this page. The contributor says in gist:

"After lifelong association with tool men it now brings tears to my eyes when I think that our skill, like that of the Indian arrow-makers, will soon be a lost art. There will be no need of it. And the blame will be heaped on my shoulders—I'll be called the Benedict Arnold of the tool clan—but since the world has gone crazy it seems that its salvation is up to me.



"Working for many years on problems of Standardization, with results you can see around you . . . I have felt that perfection was a long way off and the question came to mind: 'Why, if a cutter can be made to do the work of dozens, and adjustable dies punch holes all over the map and milling fixtures now handle every conceivable shape, why not in the name of composite inventive genius combine it all into one simple design?'

"Thus, the germ of an idea grew and grew. By combining the fingers of a shoe machine with the arms of a linotype, a universal dividing head with a body by Piscator, and legs from a Centipede tractor with the feet, hips, torso and other appurtenances of divers machines, I turned out the first crude drawings while an engineer at the Pony firearms plant. When I submitted the idea to my fellow engineers it hit 'em like the Connecticut Yank in King Arthur's court. They said it couldn't be done, but I'd heard that before and went ahead. Now, in a small way, I've solved the problem of a world crying for more and more production. I'll not go into detailed description, which is hardly necessary since the idea is dedicated to my fellow engineers besides which the drawing leaves little to the imagination (sic!).

"P.S. to the Editors: I hope to add more as we are now developing an automatic machine for turning 'em out in quantity. As now planned, a battery of six, operated by female help, will supply the wants of the entire world."

(Signed) ***Donald A. Baker***

Well, there it is, and name it if you can! As for me, it seems that I escaped from the drawing board just in time or I'd be that way too. But thanks, Donald! Apparently, I'm not the only one to indulge in a bit of fun—or, as above, in "foolishness."

As aforesaid, I pull boners now and then. F'rinstance, we ran a story by Carl Holmer—"Repair Your Own Instruments—It Pays!"—in the February book. As usual, we wanted an author's biography, and Carl, being naturally modest, was rather sketchy when it came to details. So, in writing it up, I stated that he was born in Sweden. Now, Carl tells me he was born in Moline, Ill. Oh well, Moline, Rockford, Worcester or Sweden—what's the difference? Carl's a right guy and the important thing, to me, is that he was born—anywhere!—at a time when I could be privileged to know him. Skoal, Carl!

ASTEely Yours,

Andy

Harry E. Conrad (right), ASTE Executive Secretary, tells James B. Douglas, Chairman of Springfield, Ohio, Chapter that the new group's charter, the 76th to be granted, carries the prestige of an international engineering society

Seventh Ohio Chapter Chartered

66 Springfield Members Form New ASTE Group

SIXTY-SIX members in the Springfield, Ohio, area were chartered February 7 as the 76th Chapter of ASTE, 53 members and visitors attending the charter dinner at the Shawnee Hotel.

Second Vice-President Irwin F. Holland of Hartford, Conn., presented the charter and administered the oath of office to the newly-elected Chapter executives. Mr. Holland spoke briefly on the background, purposes and aims of the Society.

Harry W. Conrad, Executive Secretary from the Detroit office, conducted the election of officers. Those elected are: Chairman, James B. Douglas, Tool Engineer, The Ross-Willoughby Co.; First Vice-Chairman, Harry F. Good, Owner, Lagonda Tool and Engineering Co.; Second Vice-Chairman, Thomas B. Shea, Manager, Fractional H.P. Div., Robbins & Myers, Inc.; Secretary, Joseph E. Charters, Assistant Industrial Engineer, The Oliver Corp.; and Treasurer, Roy H. Mumma, Owner and Manager, Mumma Engineering Service, Springfield.

Discusses Membership Activities

Mr. Conrad explained the relationship of the Central Office to Chapters, and Howard Volz of Columbus, Vice-Chairman of the National Membership Committee, spoke on membership activities.

After the chartering ceremonies, the film, "Wheels Over India," was shown.

Organization work preceding the formation of the Chapter was headed by Chairman J. B. Douglas who anticipates a greatly increased membership in the near future.

In addition to Springfield, the communities of Urbana, New Carlisle and Osborn are represented in the Chapter's membership. The second Thursday of the month has been designated as the Chapter meeting night.

Charter members, in addition to the officers, are: L. E. Abbott, W. H. Anderson, M. W. Bailey, A. C. Barth, James Bay, G. W. Bechtell, C. M. Brehm, F. A. Bushu, Frank E. Campbell, J. R. Carson, D. D. Cleghorn, P. G. Craver, Ralph Davis, H. H. Drews, J. N. Dye, G. N. Fairchilds, J. W. Fenton, M. E. Fisher, J. H. Fortney, E. W. Evans.

E. F. Fowle, D. E. Garrett, T. W. Grube, G. H. Hagerman, W. F. Hannahan, L. L. Hannum, R. L. Horstman, R. L. Houseman, E. V. Hursh, R. S. Iglehart, L. B. Keefer, Jr., Kenneth Kessler, J. N. Klopf, Charles Kraus, F. C. Lawyer, F. J. Lieb, E. L. Maurer, W. P. Metz, Jr., F. A. Montei, Jr., Orly Musgrave, E. M. Neff, Robert Nevins, Clark E. Patton.

Charles W. Patton, A. E. Payne, J. W. Powell, Jr., C. R. Ransbottom, J. H. Reinheimer, M. W. Rice, George N. Sanders, A. W. Schmid, L. D. Smith, E. E. Snider, Earl E. Stelzer, W. J. Suskitus, H. N. Titer, E. A. Ulliman, H. A. Unum, W. O. Yeazell, Herbert A. Young, and Robert J. Wagner.

The new Springfield Chapter is the fourth to be chartered in a city of that name, the other three being in Massachusetts, Vermont and Illinois.

Boston Chapter Conducts Course at M.I.T.

A COURSE of lectures, presented at Massachusetts Institute of Technology under the sponsorship of Boston Chapter and drawing an attendance of between 75 and 100 members at each session, is the achievement of the 1946-47 Education Committee of that Chapter.

The successful program was the result of intelligent preliminary work, carried out with typical New England thoroughness, by a committee headed by Joseph P. Crosby, Vice-President in Charge of Sales, The Lapointe Machine Tool Co., Hudson, Mass. Assisting Mr. Crosby were Prof. Prescott A. Smith, Professor of Mechanical Engineering at M.I.T.; Frank H. Leonard, Standards Engineer at Pneumatic Scale Co.; Cecil Lockwood, Equipment Engineer, United Shoe Machinery Corp.; Charles C. Gorham, Director of Apprentice Training, Victory Plastics Co.; and Oliver W. Bonnafe, Development Engineer at Lapointe.

After the lecture project was determined, the membership was surveyed as to their interest in such an undertaking, type of program preferred, whether they wished transcripts of the lectures and would be willing to compete for a prize with a thesis written at the conclusion of the course.

Of the approximately 450 members, 88 indicated a desire to participate in the course. Nearly all of those interested wished to attend the entire five lectures and receive transcripts. More than half were willing to submit a thesis, and the majority preferred programs divided into two periods for lecture and discussion.

With this tangible and encouraging data, the Committee developed the following course presented weekly from January 16 to February 20:

SELECTION OF MATERIAL, Paul Farren, President, Springfield Heat Treating Corp. A general outline of the manufacture of iron and steel with a description of the principal elements of tool steel and their effects.

INTERCHANGEABILITY, Glenn Stimson,

A panel discussion climaxed the course of tool engineering lectures at M.I.T., sponsored by Boston Chapter. From left: Dudley Bach and H. H. Lundstrom, instructors; P. A. Smith, Asst. Prof. at M.I.T., and C. A. Lockwood, Panel Chm., both of the Chapter Education Com.; L. W. Macomber, instructor; J. P. Crosby, Education Chm.; and C. C. Gorham, member of Chapter and Natl. Education Coms. Right: Part of class attending final program of the series

Chief Engineer, Gage Div., Greenfield Tap and Die Corp., Greenfield. A summary of standardization and its progress; gaging practice and definitions of tolerances, limits, clearance allowance, bilateral and uni-lateral production tolerance. Methods by which production limits may be controlled by interchangeable manufacture, the cost versus tolerances.

ANALYSIS OF DRILL JIG DESIGN, Frank W. Curtis, Consulting Engineer, Induction Heating Corp. Diagrams of jig and fixture principles shown on the screen by an opaque projector. Analysis and selection of methods for the economical production of parts. Object, purposes and advantages of a drill jig. Factors in design of drill jig.

DRILL JIG DESIGN, Frank W. Curtis. Projected diagrams showing principal features of a good drill jig, such as the clamp design and ejectors.

PANEL DISCUSSION led by Cecil W. Lockwood of the Education Committee. Speakers and their subjects: A. Dudley Bach, President, New England Metallurgical Co.—"Selection of Materials"; Harold H. Lundstrom, Chief Engineer, W. H. Nichols & Sons, Waltham, Mass. —"Drill Jig Design"; and Leroy W. Macomber, Supervision Tool and Gage Service Div., General Electric Co.—"Interchangeability."

Students Participate

The discussion reviewed previous lectures and endeavored to enlarge on certain aspects, with the class taking an active part in the forum.

A stenotype report of the course was mimeographed and made up into hundred-page notebooks for distribution to each student and as a basis for future courses.

To further publicize the course, a letter was mailed to employers of Chapter members, announcing the program and setting forth the educational aims of Boston Chapter in relation to the upgrading of personnel to help maintain the prestige of New England industry.

Mr. Crosby, Chairman of the Education Committee and a Harvard graduate, has prepared a comprehensive report on the project, including a breakdown of the Chapter survey, a detailed outline of the course, the letter sent to Boston executives, and the budget approved by the Executive Committee, to underwrite the enterprise. Other Chapters, contemplating similar educational programs, may find the report helpful.

Another project executed by the Education Committee was the reviewing of trade papers and the securing of reprints of articles desired by members.

Previous Committees had established a $500 scholarship at Massachusetts Institute of Technology, from which a $100 prize is to be offered annually for the best graduation thesis on a subject related to the professional field of tool engineering.

Through this scholarship, the Chapter hopes to found a course in tool engineering that will be a part of the fundamental training of prospective tool engineers. Because of wartime conditions, no student has qualified for the award, but it is expected that the first winner will be announced in June of this year.

Photo courtesy Western Metals Magazine

President's Night in Los Angeles found this group at the speakers' table. From left: H. L. Miller, Entertainment Committee; J. A. Parks, Secretary; Merton Seavey, Standards Chairman; Rudolph Regen, Editorial Chairman; R. H. Powroznik, Membership Chairman; D. R. Linch, Past Chairman; G. J. Walkey, Treasurer; Clare Bryan, Chairman, Chicago Chapter and technical speaker; L. F. Hawes, First Vice-Chairman; Anton Peck, Chairman; A. M. Sargent, President; A. J. Denis, National Director; and A. D. Lewis, Delegate

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New Products Exert Engineering Challenge

Los Angeles, Calif.—While war emphasized the tool engineer's important role in mass production of weapons and mechanical devices, he occupies no lesser place in peacetime when a greater diversification of products taxes his ingenuity to implement their manufacture in greater volume and higher quality at the lowest cost.

But thousands still have no knowledge of the tool engineer's value, declared A. M. Sargent, retiring ASTE President and guest speaker at a recent meeting of Los Angeles Chapter.

They wonder, he added, what may be the difference between industrial, mechanical and tool engineers. They think a tool engineer works in the dark and produces something new. "One reporter asked me," said Mr. Sargent, " 'What outstanding tool do you intend to produce in the next few years?' "

"Engineering," he continued, "is in a process of evolution and new things revert to the old. We may expect a 'new' type of automobile engine having only four cylinders of 6" bore; instead of carburetion it will have fuel injection, will idle at 75 rpm, where few now idle at 250, some at 400, and mine at 1000-rpm."

The speaker outlined the Society's efforts in educating the public, industry and teaching circles concerning the tool engineer's position in our economic life.

Clare Bryan, Consulting Engineer, Link-Belt Co., Chicago, and retiring Chairman of the ASTE Chapter in that city, presented the technical program of the evening, "Practical Engineering of Jigs and Fixtures." With the aid of slides, he described many advanced tooling methods.

Ladies Night at Muncie Chapter was observed with dinner dance in Masonic Temple, professional entertainment and Harry Coopland's address on the practicability of the Golden Rule in business and industry

Ladies Entertained At Dinner Dance

Muncie, Ind. — Approximately 110 members and guests of Muncie Chapter enjoyed the Ladies Night dinner dance recently held in the Masonic Temple Ball Room.

During and after dinner, guests were entertained with violin and accordion duets and a comic magician.

Speaker of the evening was Harry Coopland, Special Representative of Jack & Heintz, Inc., Cleveland, Ohio, whose subject "Seeing Is Believing," dealt with the practicability of the Golden Rule in business and industry.

The remainder of the evening was devoted to dancing to the music of "Hod's" Band.

Charles R. Staub of Michigan Tool Co., D. W. Dudley of General Electric Co., and John C. Dixon, Pratt & Whitney, Div. Niles-Bement-Pond Co. (right view) participated in Boston Chapter's Gear Finishing Symposium. Professor Earle Buckingham of M.I.T. was a guest. Left: Clive Warren of Wade Tool Co., Waltham, gives a demonstration while describing an unusual method of burring and bevelling edges of gears

Machine Not Detrimental To Workers' Economy

San Francisco, Calif. — Golden Gate Chapter played host to A. M. Sargent, retiring ASTE President, at a recent meeting in the City Club Hotel, Oakland.

Edward J. Raves, Chapter Chairman, introduced Mr. Sargent to the assembly of 115 members and guests. In his address, Mr. Sargent outlined the function of the tool engineer and painted a vivid word picture of his influence in bringing mankind the benefits of modern industry.

Dwelling upon the subject of high production laborsaving machinery, the speaker ably refuted the specious argument that such devices are, over a long period, injurious to the economy of laboring groups.

In lighter vain, he described his visit to San Francisco which included a trip to the topmost point of the Golden Gate Bridge and a welcome from the Mayor's office.

Clare Bryan, Consulting Engineer for Link-Belt Co. and retiring Chairman of Chicago Chapter, followed Mr. Sargent with a technical lecture, "Practical Engineering of Jigs and Fixtures." Mr. Bryan presented with slide illustrations, some exceedingly interesting applications of hydraulic principles in the design of jigs and fixtures.

Of particular interest was his account of the standardization of tools and equipment, including boring bars, tool holders and clamping devices, extensively developed by Link-Belt to aid in the manufacture of their products.

A description of methods used to complete unusual machining operations, including the grinding and turning of spherical parts, aroused great interest and discussion among engineers concerned with high volume production.

Heat Treating Presented In Motion Pictures

Pontiac, Mich.—A program of induction heating was presented to members of Pontiac Chapter by representatives of the Induction Heating Div., The Budd Co., Detroit, at a meeting held recently in the Pontiac Motor Div. Personnel Building.

The speakers, Carl F. Schwartz and Edward J. Fay of the Sales Dept., illustrated their subject, "Heat Treating I.D. of Cylinders," with motion pictures. An open discussion followed the presentation.

The Chieftains, a barber shop quartet, entertained with vocal selections.

Eldon Hall, Claude Osborne and George Bryan were elected a Nominating Committee.

Gear Finishing Symposium Treats Three Angles

Boston, Mass. — A three-part gear finishing symposium was the technical presentation at a recent meeting of Boston Chapter in Schrafft's Restaurant.

John C. Dixon, Equipment Engineer, Pratt & Whitney, Div. Niles-Bement-Pond Co., of West Hartford, Conn., was the first speaker. Mr. Dixon, in a slide-illustrated talk, "Grinding of Spur and Helical Gears," discussed the history, development, applications and technique of gear grinding.

"Cross Axis Gear Shaving" was explained by Charles R. Staub, Chief Engineer, Michigan Tool Co., Detroit.

D. W. Dudley, Gear Engineer, General Electric Co., River Works, West Lynn, Mass., completed the program with comments on "The Shop's Viewpoint on Gear Finishing."

Before the main feature of the evening, Clive Warren, Superintendent, Wade Tool Co., Waltham, Mass., gave a gadget talk on a unique way of burring or beveling edges of gears.

One hundred and forty members and guests attended the dinner meeting.

Special Tooling Setups Shown by Meyer

Hamilton, Ont.—Technical speaker at a recent meeting of Hamilton Chapter was A. W. Meyer, Assistant Director of Design, Brown & Sharpe Co., Providence, R. I., who discussed "Special Tooling Applications for Milling and Grinding Machines." Slides, illustrating the talk, showed several sizes and styles of machines with various setups.

The very active question period which followed the talk was ably handled by the speaker.

During the evening, Charles T. Kemp, Entertainment Chairman, provided enjoyable entertainment presented by a group of employees from the National Steel Car Co.

New Uses of Broaching Demonstrated in Films

Hartford, Conn.—Fred F. Sleeper, Assistant Chief Engineer of the Lapointe Machine Tool Co., Hudson, Mass., was a recent speaker before 175 members and guests of Hartford Chapter.

His address on the history of broaching was illustrated with two motion pictures showing new applications and advantages of broaching.

Mr. Sleeper stressed the broach manufacturer's important part in taking advantage of this economical machining process. An interesting question period closed the meeting.

During the business meeting which preceded the technical session, the members elected as Chapter Nominating Committee: George A. Highberg, Chairman Henry A. Rockwell and Carl W. Moeller.

* * *

"Analysis of Drill Jig Design" was presented at the previous meeting by Joseph I. Karash, Plant and Process Engineer for the Reliance Electric and Engineering Co., Cleveland, Ohio.

Design he defined as a mental processing of machine tools and drafting as a descriptive reference record, with shop theory and technical experience in harmony.

In designing tools, he added, a plan of procedure should be developed: 1. Part to be made; 2. Type of machine; 3. Type of drill jig; 4. Tolerance of dimensions such as size and position of holes; 5. Skill of operator; 6. Requirements of pieces to be made and holes to be drilled. The speaker illustrated with slides.

Gearing, Equipment Shown In Films and Display

Chicago, Ill. — Approximately 150 members of Chicago Chapter heard George H. Sanborn, Chief Field Engineer for The Fellows Gear Shaper Co., Springfield, Vt., discuss "The Art of Generating and Gear Manufacturing Equipment" at a recent dinner meeting in the Furniture Club.

G. H. Sanborn

Mr. Sanborn augmented his presentation with sound-color films illustrating gear theory, design and action, applications of the generating principle, and equipment for gear cutting, finishing, measuring and testing.

An exhibit of samples and plastic models was displayed at the conclusion of the question period following Mr. Sanborn's lecture.

Rachel G. Conover, feminine member from Philadelphia Chapter, seems to be the center of interest in this dinner table group at a recent meeting of Golden Gate Chapter in City Club Hotel, Oakland, Calif. From the left: Florindo Viti, Secretary; Miss Conover (obscured); Clare Bryan of Link-Belt Co., technical speaker; Edward J. Raves, Chairman; A. M. Sargent, retiring ASTE President and guest speaker; Ernest C. Holden, Second V.-Chairman; Floyd Snodgrass, First V.-Chairman; and Henry Hagedorn, Chapter Treasurer

M-H Shows Manufacture Of Control Equipment

Minneapolis, Minn.—One hundred and eighty members and guests of Twin City Chapter participated in a recent tour of the main plant of Minneapolis-Honeywell Regulator Co., said to be one of the world's largest manufacturers of automatic control instruments and equipment.

After a dinner in the plant cafeteria, the group was welcomed by Elmer H. Swensen, Assistant Superintendent of Tool Departments. Approximately 20 ASTE members of the company staff were introduced and served as guides for one of the most interesting Chapter events of the year.

The manufacturing departments, all containing much new and modern equipment were given a close inspection by the visitors. One of the larger and more modern shops in the upper Midwest, the tool room was of prime interest.

For the unusual and more spectacular, the mercury switch department gave the party an opportunity to see the manufacture and assembly of mercury-filled glass tubes used for innumerable applications of electric switching.

The plastic molding department, recently moved to its own building, had most of its 34 molding presses in operation. Of these, 15 are specially designed presses used for transfer molding. Two new Reed-Prentice diecasting machines were also the object of careful scrutiny.

Mathematician Discusses Magnetic Chuck Control

Springfield, Vt. — Charles D. Briggs, Sales Engineer for the O. S. Walker Co. of Worcester, Mass., addressed Twin States Chapter at a recent meeting in the Adnabrown Hotel.

Mr. Briggs' subject, "Magnetization and Its Adaptability to Holding Problems," was illustrated with appropriate electrical equipment and was slanted to engineering interests, dealing specifically with the problem of controlling the field intensity on magnetic chucks as used on milling machines.

Mr. Briggs, a mathematician of note, holds several honorary and scholastic degrees and is credited with the invention eliminating cable interference, perfected while he was supervising the laying of cables from Halifax to Cuba during World War I.

Heatless Repair Method Mends Damaged Castings

St. Catharines, Ont. — A heatless method of repairing cracked or broken castings, called "Metalock," was described by Thomas O. Oliver, Jr., of Metalock Casting Repair Service, to 80 members and guests of Niagara District Chapter during a recent meeting at Fox Head Inn, Niagara Falls.

T. O. Oliver

Mr. Oliver explained that a prefabricated, specially designed alloy lock of precise dimension is inserted in a prepared aperture in the parent metal. These apertures transverse the crack at right angles and are machined slightly smaller than the lock, which is driven in by an air hammer and shears its way to the bottom.

Grips Firmly

The side walls are perpendicular, but small anchor holes are drilled at 45° angles at the bottom of the slot so that, when the lock is driven home, it has room to flow under the working of the hammer and is thus given a better grip.

Subsequent locks may be driven on top of the first until an aperture 2 or 3 inches deep is filled. The material, known as "metalloy," consists of 65% steel and 35% nickel. It is highly ductile, strong, elastic and rustproof.

To prevent a continuation of the break or crack, the locks are put in tension by inserting threaded studs of metalloy along and within the fracture itself. The holes to accommodate the "metalace," as the studding is known, are slightly smaller than the studding which is inserted by means of a special wrench, tending to fill the crack and distribute compression over a much wider area. When the crack has been completely studded from one end to the other and peened, it is solid metalloy along the entire fracture.

The repair of broken cast iron castings by welding, Mr. Oliver indicated, is not entirely satisfactory because the application of heat not only disturbs the structure of the iron itself, but causes distortion that often necessitates normalizing and remachining.

Stresses, strains and even cracks often occur in machine castings during pouring and cooling. As long as these cracks do not alter the alignment of the casting, they are often considered beneficial in that they provide a stress relief. A repair method employing heat sometimes results in a new fracture in the damaged area. The Metalock method uses no heat and allows the crack to remain in the metal to serve as a stress relief, the speaker pointed out.

After the lecture, Ronald Tipping of Otis-Fensom Elevator Co., Hamilton, showed a sound film on Meehanite.

Unique Plant Operations Seen in Editor's Travels

York, Pa.—A miniature tour of interesting and unusual manufacturing processes, on a countrywide scale, was enjoyed by Central Pennsylvania members who heard Charles A. Herb, Editor of *Machinery*, describe "Outstanding Operations in Shops from Coast to Coast."

Speaking before a recent Chapter meeting at the West York Inn, Mr. Herb illustrated the highlights of his address with slides.

Beginning with an explanation of the extrusion of collapsible tin tubes used for packaging toothpaste and similar products, he went on to show how the same cold impact method was used for extruding aluminum aircraft parts to close tolerances. Aluminum alloys and magnesium have also been impact extruded after heating.

Applications, advantages and processing of magnesium alloys were related by Mr. Herb, as well as the extrusion of nickel, Monel, Inconel and other high nickel alloy tubes.

Present industrial applications in casting high temperature resisting alloys, difficult to forge, were traced back to the original lost wax process used by the ancient Chinese and Egyptians.

Recent advances in powder metallurgy were pointed out in a technical description of the time and material saving process.

Gear hardening by induction heating, the drawing of automobile engine push rods from flat disks, making of jig nest blocks from sprayed metal shells deposited on plaster forms, and negative rake milling applications in aircraft manufacture were also discussed in considerable technical detail.

During Twin City Chapter tour of Minneapolis-Honeywell Regulator Co., Fred S. Eklund (nearest machine), Tool Room Foreman, explains to his fellow members the operation of a new Kearney & Trecker No. 2D Rotary Head Milling Machine as it works on a plastic mold cavity. Right: Andrew G. McNicoll, Technical Supervisor—Tool Design, shows the result of a Brehm trimming die operation on a drawn case in the punch press department of the plant

A program on "Selection and Heat Treatment of Tool and Die Steels" was recently presented to Syracuse members by representatives of Latrobe Electric Steel Co. From left: L. C. Grimshaw, Chief Metallurgist and technical speaker; M. D. Wilbur, Sales Eng., and Ray T. Kells, Chief Service Eng., who conducted discussion period. Center: In this group chatting at the close of another meeting are Hugo Klix, Program Chm.; W. A. Ruppel, Eastern Carbide Supervisor, and D. J. Andrews, Central N. Y. Rep., Firth Sterling Steel Co. Right: Part of dinner group present for Firth-Sterling program

Syracuse Hears Carbide and Tool Steel Discussions

Synthetic Rubber Tires Adaptable in Heat, Cold

Los Angeles, Calif.—Synthetic rubber tires have been developed to such a degree that they will perform well in temperatures ranging from the frigid atmosphere of the Alcan Highway to the burning heat of the desert, Lt. Col. J. J. Robeson, Manager, Manufacturers Sales Div. at the Los Angeles Firestone Tire and Rubber Co. plant, informed Los Angeles Chapter members during a recent Chapter technical session.

Col. Robeson, in his address, "The Building of a Tire," further stated that GR-S, Government Rubber-Styrene, proved fully satisfactory for military service. Although this rubber is less resilient than its natural counterpart and gets hotter on the road, since more energy is transformed into heat, the company claims to have fewer adjustments now than with prewar natural rubber tires.

Because of this higher rolling resistance of synthetic tires, gasoline consumption is increased about 6%, a negligible amount compared with the fuel wasted during a jack rabbit takeoff.

Chemicals Prolong Tire Life

Abrasion resistance of rubber is very materially increased by the admixture of carbon black. In the tread this is 30-50% and, in the carcass, 14-18%. Addition of deoxidants imparts good aging and weathering characteristics, while sulphur, with the aid of accelerators, facilitates vulcanizing at modern rates of production.

Important in the construction of automobile tires are the cords which form the skeleton. Originally cotton cord was used with a tensile strength of 18 lbs. per strand. Now all passenger tires of size 6.50 and larger are built with rayon cord with a tensile strength of 34 lbs. Airplane tires are made with lightweight nylon cord, strongest of the three fibers but inadequate to withstand temperatures encountered in highway service. New truck tires use a three-ply steel cord twice as strong as 14-ply cotton cord.

Synthetic rubber for inner tubes, the speaker said, is made by bringing together two colorless gases at a temperature of minus 140°F. This rubber will hold air ten times as well as natural rubber, but is without resiliency.

Although the Germans began their synthetic rubber program in 1934, the United States surpassed them in one year, said Col. Robeson who was engaged in the development of synthetic rubber tires during the war.

After showing a sound-color film, he answered many questions from the audience.

The evening's program was rounded out by the showing of a technical film, "Crush Form Contour Grinding," released by the Thompson Grinder Co.

Four Phases of Carbides Discussed in Symposium

Philadelphia, Pa.—A carbide symposium sponsored by four manufacturers in this field drew an overflow attendance of approximately 325 at a dinner meeting recently held by Philadelphia Chapter.

Malcolm F. Judkins, Chief Engineer, Carbide Div. of Firth-Sterling Steel Co., was the first speaker. He discussed "Tools and Wear Parts," specifying requirements for cutting tools, qualities of carbide, and advantages and limitations to be considered in the design of carbide tools. He also cited a number of outstanding carbide applications.

"What the Tool Engineer Should Know About Carbides" was explained by J. M. Bertotti, Director in Charge of Sales Training for Carboloy Co., Inc.

M. F. Judkins

J. M. Bertotti

The success of cemented carbides, Mr. Bertotti stated, was credited by the Ordnance Dept. with reducing the number of workers required to machine shells for World War II to one-sixteenth of those needed to do comparable work in the first world conflict. Over 50 per cent of all metal cutting in this country is now done with carbide tools, he added.

Tooling with carbides affords an opportunity for management to offset with higher machine production the increased cost of raw materials, overhead and labor.

The speaker listed physical properties of carbides with which the tool engineer should be familiar and referred to the training school maintained by his company.

Burton E. Middleton, District Manager of Kennametal, Inc., lectured on "The Mechanical Holding of Carbides." Factors determining the extent of a cutting job were enumerated. While brazed tools give satisfactory service for light machining of steel parts on medium sized machines, heavy cutting often produces a crack in the tool tip.

Advantages and disadvantages of clamping carbide tips were then compared with brazing results.

The final speaker, H. B. Clark, General Manager of Vascoloy-Ramet Corp., concluded the symposium with a discourse on "Carbide Dies." He traced the history of dies used in wire making, illustrating the technical and economic problems involved. Comparisons were made between the use of diamond dies in making copper wire and carbide dies in steel wire making. Tribute was paid to the die users for their contributions in technical research and financial venture.

An exceptional degree of interest was shown in the ensuing question and answer period.

The resignation of Alfred S. Elston, Education Chairman, prompted by his removal to Flint, Mich., was announced. James A. Brooks was appointed to Mr. Elston's post.

Chip Collection Reduces Magnesium Fire Hazard

St. Charles, Ill.—Seventy-three members and friends of Fox River Valley Chapter met at Hotel Baker recently to hear representatives of Hills-McCanna Co. and Revere Copper and Brass, Inc., present a program on Magnesium.

A. B. Two of Revere read a paper on the metallurgy and types of magnesium alloys. This was followed by a discourse on the past, present and future of magnesium alloys, presented by D. W. Moll of Hills-McCanna Co.

Until the relatively recent development of extracting magnesium from sea water, Mr. Moll said, the only sources were mines and salt wells. Before wartime demands promoted applications and disclosed the many uses of magnesium, the high cost of casting limited its use. Now there are very few metallic applications in which magnesium alloys cannot be used.

With the development of rolled stock, magnesium alloys are even replacing wood, he added. Its extreme light weight and high structural strength offer advantages in fields where heretofore designers were faced with a weight problem.

Chip Fire Easily Extinguished

The subject of fire hazard was discussed by Mr. Moll. He showed that by exercising a few simple precautions there is no more risk than when working with other combustible materials.

In the machine shop, the keynote of safety is in good housekeeping. Chips should not be allowed to accumulate, but should be collected periodically and placed in closed metal containers. A magnesium chip fire is slow burning and can be easily extinguished by covering it with a special powder provided for that purpose. Water on burning magnesium is extremely dangerous because the intensity of the heat in the flame breaks down the steam generated into hydrogen gas and oxygen, and the combustion of hydrogen causes a violent fire.

Fire hazard is present only when the metal is in the form of fine chips; a large block of magnesium alloy is no more subject to combustion than is a similar piece of wood, declared Mr. Moll.

Following the two lectures, a sound film was shown, depicting the many phases of magnesium alloy production, fabrication and use. Samples of magnesium alloy parts were on display.

British Fuel Crisis Strains Industry's Resources

Dunstable, Beds., England—Paralysis of transportation has been the crux of the winter domestic crisis suffered by Great Britain for more than two months, according to L. H. Rhodes, General Manager of S. Carlton Smith, Ltd., Dunstable, and a member of ASTE.

L. H. Rhodes

"With 26 main line railways," he says, "frozen solid and blocked for miles by 30-foot snow drifts, clearing the rails has been almost impossible. Whole trains have been lost for three weeks during which there has been no let up or thaw to enable us to make any headway. The same applies to roads, and in some instances snow drifts were within three feet of the tops of telegraph poles.

"Except for a slight 12-hour thaw, the temperature has not been above freezing point for two months, the whole country has experienced heavy blizzards, and it is still snowing. [As of March 6, Mr. Rhodes stated that they were still snowbound and freezing.]

"In normal times it would be serious enough because no undertaking would carry stocks of fuel for two months or more. Although the final decision to cut down industry was a last resort, it did become necessary to take this extremely drastic step.

Equipment Frozen

"Such conditions had never been met with before. Coal miners were unable to get to the mines, their path blocked in all directions by six feet of snow, and all gear above ground frozen solid and immovable. As soon as it was possible for them to resume work, the miners made a magnificent response, and coal production has now exceeded the peak prewar figure with fewer men employed, but the danger has not yet passed.

"As most of the overland transport has been unworkable, coal supplies have been shipped by colliers as far as possible, and the risk taken by these men is greater than at any time during the war. Imagine putting out to sea in a 5,000-ton cockleshell of a boat in a raging blizzard and heavy sea with a temperature something like 20° below zero. In many instances these ships arrived in port with a dangerous list due to cargo movement and with the crew absolutely exhausted after being on duty for days on end without sleep.

"Sufficient coal stocks have been maintained to enable power stations to run essential services, but this has been achieved only by hand to mouth methods and switching off all domestic supplies for several hours a day. Should the power stations fail, it would be disastrous to hospitals and similar vital services.

"The Army and Navy have been pressed into service to help in clearing transport and to give any other assistance possible, but even so it has been a herculean task to get fuel to the power stations. The Government is allowing some resumption of work in the Midlands, but unfortunately we are outside that area.

Union Terms Cause Unemployment

"At present our office staff, dressed like Eskimos, is crowded into one small office with two small paraffin stoves in a vain endeavor to keep warm, in order to deal with urgent correspondence which is usually finished by mid-day. Owing to the fuel crisis most of our employees have been stood off and in some cases handed notices of termination of employment because there is an agreement with trade unions that while a man is employed he must be paid for a guaranteed week of 34 hours.

"Although most firms have stood this for two weeks, it has become a considerable drain on financial resources. There is one bright spot, however, in that the income tax authorities have to pay us for a change, a pleasure most of us would not miss in spite of the fuel crisis.

"President Truman's offer to assist Britain by the redirection of American coal ships was met with a cheer. Although for some reason we are not able to take advantage of this offer, the gesture was very much appreciated.

"There has been quite an uproar in Parliament, but the Government opposition do not appear to have made much success of their criticisms, as everyone knows that such weather conditions could not have been foreseen and no amount of planning could have coped with the present situation.

Government Failed to Give Warning

"On one point everyone agrees—that the Government should have intimated that a stoppage might be necessary due to diminishing fuel stocks, instead of breaking the news on a Friday evening without any previous warning. No doubt they hoped as we did that the weather would break any day and allow normal resumption of industry.

"Of course many people have been blamed, but the general public in England is of one opinion that if any blame at all is attached to this matter, it is to the Governments between the two wars. Neglect of all our industries during the slump period was nothing less than criminal negligence on their part and several industries were ruined by their shortsightedness.

"In 1936 I visited various English mining districts on business and saw most distressing conditions. In some towns in the North of England, Scotland and Wales, unemployment was 100% and there appeared to be no hope for the future. Most of the industries involved were heavy ones such as coal and steel, and skilled craftsmen and miners left these districts by the thousands, vowing never to return.

"Within one mile of our works, we have a settlement built especially for such Welsh miners and accommodating approximately 100 families. These men were brought here during the slump period to try and rehabilitate them on the land or in other industries. None of them would return to the mines under any conditions and they would also prevent their sons from taking up mining as a career. Until this distrust is overcome and workers are assured of some security, many industries will never flourish and it will take years to live down this sense of insecurity."

Mr. Rhodes also indicates that he hopes to be one of a party of British Gauge and Tool Makers' Association members planning to visit the ASTE Exposition, expected to be held in Cleveland in 1948.

Successful Nimrods

Walter B. Pohle (left) famous Boston Chapter gadgeteer, usually brings down a deer during his trips to New Brunswick, Canada, in addition to dreaming up a new gadget or two to patent upon his return to civilization. At right is his friend Cecil Gavel of Lynn, Mass., with his kill

Recommends Steels For Tools, Gages

Erie, Pa. — A. H. d'Arcambal, Vice-President - Consulting Metallurgist of Pratt & Whitney, Div. Niles-Bement-Pond Co., West Hartford, Conn., and a former ASTE President, addressed approximately 100 members and guests of Erie Chapter at a meeting held recently in the General Electric Community Center.

A. H. d'Arcambal

In the treatment of cutting tools for longer life, Mr. d'Arcambal is of the opinion that nitriding is a "must" for reamers and gages. Many case histories of reamer and gage application, he said, have shown that nitriding is superior to chrome plating. Sub-zero treatment of tools and gages has very little effect on tool life if the correct heat treatment has been used. However, he does feel that sub-zero treatment is useful for stabilization of gages and in the assembly of parts by shrink fits.

Prefers Tungsten H.S.S. to "Moly"

Large quantities of plain carbon tool steel are still being effectively used for cutting tools, Mr. d'Arcambal pointed out. While the "moly" type high speed steel of wartime is still widely used for twist drills and other tools, high tungsten high speed steel is definitely superior on many operations, he believes.

With slides, the speaker gave a very complete presentation of the various materials available for cutting tools and gages, high speed steels, cast alloys, carbides, synthetic sapphires and boron. The pictures included some excellent photo-micrographs of the materials touched upon, as well as charts showing tensile strength, modulus of elasticity and hardness.

Mr. d'Arcambal spoke briefly about his trip to Germany during the closing days of World War II. As one of the engineers selected to inspect German industrial processes, he had the opportunity to observe the quality and quantity of German machine tools and factories. He is of the opinion that the breakdown of German transportation and fuel supplies caused by Allied bombing played a large part in terminating the European war.

The session concluded with a question and answer period. A splendid selection of tools was arranged for inspection.

Seekins Wins G.E. Award

West Lynn, Mass.—Harold L. Seekins, Planning Engineer in the Aircraft Gas Turbine Manufacturing Div., General Electric Co., River Works, has received the coveted Charles A. Coffin Award, highest employee honor conferred by General Electric Co.

H. L. Seekins

The award, established "for the encouragement of signal contributions by employees of the General Electric Company toward the increase of its efficiency or progress in the electrical art," was bestowed on Mr. Seekins and 94 other employees throughout the company in recognition of their wartime achievements. It is given in tribute to Charles A. Coffin, one of the company's founders and its first president.

The citation, accompanying Mr. Seekins' engraved certificate and cash honorarium, reads: "In recognition of his outstanding contribution during World War II to the art of manufacturing superchargers by a superior balancing process."

Joining the Aircraft Gas Turbine Div., early in 1939 as a Planning Engineer on the turbosupercharger project, he rendered valuable service during the war in helping implement the mass production of turbos for the AAF.

Mr. Seekins is a member of the Program Committee of Boston Chapter, ASTE, and formerly served on the Entertainment Committee.

ASM-ASTE Joint Meeting Features Carbon Steels

Boston, Mass. — Speaking before a capacity audience of Boston ASM and ASTE members, James P. Gill, Vice-President of Vanadium-Alloys Steel Co., Latrobe, Pa., gave a thorough presentation of carbon tool steels.

Host for the recent annual joint meeting of the two Societies, held in the main ballroom of the Hotel Bradford, was the local ASM group.

Mr. Gill, the guest speaker, presented slides, illustrating such points as the composition of carbon tool steels as affected by small amounts of residual elements; the structures that result from annealing, normalizing, and treating, factors influencing the hardenability, dimensional changes that result from treatment, physical properties and applications.

Chairman for the technical session was J. V. Baxter of United Shoe Machinery Corp., Beverly, Mass., Past Chairman of ASM and an active member of Boston Chapter, ASTE.

In an earlier address, Erwin D. Canham, Editor of *The Christian Science Monitor,* an international daily newspaper published in Boston, considered "The Outlook for Peace."

Another speaker, ASTE President A. M. Sargent, reviewed the Society's background, its purposes and aspirations.

ASTE officers presented from the speakers' table included, in addition to Mr. Sargent: I. F. Holland, Second Vice-President; V. H. Ericson, National Treasurer; and Boston Chapter executives: J. B. Savits, Chairman; J. X. Ryneska, First Vice-Chairman; W. W. Young, Second Vice-Chairman; W. C. Swanson, Secretary; and A. J. Leone, Treasurer.

Modern M.S. Machines Increase Production

Rochester, N. Y.—"Tooling Multiple Spindle Automatic Bar and Chucking Machines for Higher Production" was recently presented to nearly 200 members and guests of Rochester Chapter at a dinner meeting in the Rochester Institute of Technology.

Speaker for the occasion was Robert R. Rhodehamel, General Sales Manager, National Acme Co., Cleveland, Ohio.

Mr. Rhodehamel opened his discussion with a brief resume of the founding of his company in New England and its subsequent removal to Cleveland. He sketched the development of the machines from the first small automatic to the present huge eight-spindle model with its 34,000 pound carrier.

By means of slides he showed the operation and tooling on various pieces such as a bicycle hub, gears, hand wheels, pulleys and shafts, comparing former and current production rates.

Experimenting with Carbides

The speaker showed a typical cam and tool layout and stated that carbide tools as applied to smaller parts are still in the experimental stage; on larger chucked parts, progress is being made with carbides, he added.

E. H. Goebel, Instructor in Screw Machine Engineering at RIT and a well-known expert in that field, discussed the growth and accomplishments of the screw machine industry.

Chairman Charles Seely conducted the election of a Nominating Committee. Past Chairmen Earle DeBisschop, Chauncey G. Newton and Charles E. Codd were chosen.

Robert Lewis Meyer of Fairport, N. Y., was announced as winner of the Chapter's $100 scholarship at RIT. The award is presented to the tool engineering student making the greatest progress during his freshman year.

Guests included RIT students in tool engineering and screw machine engineering.

The dinner which preceded the meeting was served by the Domestic Science Dept.

Economy and Precision Broaching Features

Grand Rapids, Mich.—Accuracy, better finish and the elimination of several milling operations were claimed as advantages of broaching by Norman H. Iversen, Chief Engineer of Michigan Broach Co., Detroit, in a recent address before Western Michigan members.

N. H. Iversen

Mr. Iversen briefly reviewed the history of broaching, then discussed its advantages and the fine points of broach making, illustrating with blackboard drawings examples of work difficult to do by other methods.

He concluded his lecture with a short film demonstrating the use of broaching tools.

In a brief business meeting, conducted by Chairman James Brierley, a Nominating Committee was chosen, composed of George Hoogerhyde, Chairman; Thomas Newby and Peter Maghielse.

Rochester members gather around Robert R. Rhodehamel, Gen. Sales Mgr. of National Acme Co., to ask questions at the close of his technical address, "Tooling Multiple Spindle Automatic Bar and Chucking Machines for Higher Production"

Coming Meetings

CLEVELAND — May 9. Allerton Hotel. Speaker: R. H. Davies, Consulting Engineer, Lincoln Electric Co. Subject: "The Latest Developments in Welding."

ERIE—May 6. Speaker: Robert Manley, Bryant Chucking Grinder Co. Subject: "Tooling for Better Internal Grinding."

FLINT—April 17. Trip through Universal Engineering Co., Frankenmuth, Mich. May 15. Subject: "Grinding Wheels and Other Abrasives, Their History and Development."

HAMILTON—May 9, 7:00 P.M., Fischer's Hotel, Ladies Night. Speaker: Peter Gellatly, Canadian General Electric Co., Ltd., Toronto. Subject: "Television."

HARTFORD—May 5, 6:30 P.M., Dinner, City Club; 8:00 P.M., Technical Session, Hartford Gas Co. Auditorium. Speaker: William H. Oldacre, President, D. A. Stuart Oil Co., Chicago, Ill. Subject: "Cutting Oils for Machining."

LITTLE RHODY—April 16, Oates Tavern. Speaker: P. D. Smith. Subject: "Jet Propulsion Turbines." May 21. Speaker: R. S. Woodbury. Subject: "Internal Combustion."

MILWAUKEE — May 14. Program on "Shot Peening" sponsored by American Foundry Equipment Co., Mishawaka, Ind.

PHILADELPHIA — April 17. To be announced. May 15. Speaker: Dr. G. M. Butler, Jr., Asso. Director of Research, Tool and Die Steel Div., Allegheny Ludlum Steel Corp., Dunkirk, N. Y. Subject: "The Manufacture and Uses of High Carbon, High Chrome, and Carbon Tool Steels."

SYRACUSE—April 15, 8:00 P.M., Onondaga Hotel. Speaker: Waldemar Naujoks, Chief Field Engineer, The Steel Improvement & Forge Co., Cleveland, Ohio. Subject: "Production Forgings and Their Relation to the Tool Engineer."

TORONTO—April 14. Speaker: Howard Mills, Bellows Senacon Co., Akron, Ohio. Subject to be announced.

Jackman Joins Stevens

Chicago, Ill.—Edwin T. Jackman is now associated with Charles G. Stevens Co. of Chicago, as Manager of their Bar Steel Division.

Prior to this appointment he had been Chicago District Manager for the Firth-Sterling Steel Co.

Mr. Jackman is a member of Chicago Chapter, ASTE.

Folding rostrum, designed and constructed by W. S. Werthmiller for Hamilton Chapter, supports speaker's papers at comfortable reading angle, provides space inside for other meeting material (left); folds compactly to carry under the arm (center); and identifies organization with the Society emblem (right)

Designs Folding Rostrum for Out-of-Town Meetings

Hamilton, Ont.—The old saw about necessity being the mother of invention has been demonstrated again by W. S. Werthmiller, Vice-Chairman, ASTE Canadian National Standards Committee and Standards Chairman for Hamilton Chapter.

W. S. Werthmiller

As his Chapter takes in the communities of Brantford, Galt, Kitchener and Guelph, in addition to Hamilton, dinner meetings are alternated in the various cities. Since this arrangement made it difficult to use a permanent speaker's rostrum, Mr. Werthmiller conceived the idea of making a collapsible support for speakers' papers.

Important requirements were to have the rostrum fold flat and also to keep weight at a minimum. The drawing of Mr. Werthmiller's design is reproduced on this page. Stock specified is 3/8" plywood.

The hinges for the top are cut out in the center to allow for a swing of approximately 285° from the folded position of the hinges, since the top of the rostrum is sloped about 15°. The hinges on the right side are fastened directly to the front piece, whereas the left side is hinged to a strip of the 3/8" plywood which is fastened to the front piece. This permits the left side to lie parallel over the right side in the folded position.

Mr. Werthmiller redrew the ASTE emblem to 11" diameter on mahogany-stained 1/16" plywood and affixed the cut-out painted motif to the front of the stand with four brass tacks. The emblem, Chapter name and number may be painted directly on the front.

Other Chapters with similar meeting problems may find the folding rostrum a handy piece of equipment.

Time Study Applied To Tool Engineering

Decatur, Ill. — Robert N. Christison, Cost Control Manager, Oakes Products, Decatur Div., was guest speaker at a recent dinner meeting of Decatur Chapter held in the Decatur Club Building. His subject was "Time Study Methods and the Tool Engineer."

Prior to Mr. Christison's address, Ray Howell, Program Chairman, presented a U. S. Secret Service sound film, "Know Your Money."

During the business meeting, Gene Carlin and Robert Howie were elected to serve as a Nominating Committee. Approximately 40 members and guests were present.

Hack Saw Blade Making And Use Described

New Haven, Conn. — From two of their own members New Haven Chapter learned about power machine hack saw blades at a dinner meeting held recently in the Dunham Electrical Laboratory, Yale University.

M. J. Weldon

The first speaker, M. J. Weldon, Metallurgist, Henry G. Thompson & Sons Co., lectured on the heat treatment and testing of blades.

He described the use of the research microscope as a routine production instrument for the heat treatment of metal cutting tools. Rapid methods of specimen preparation were explained to illustrate how they can be adopted as a control measure in the production of various multiple-point high speed steel tools.

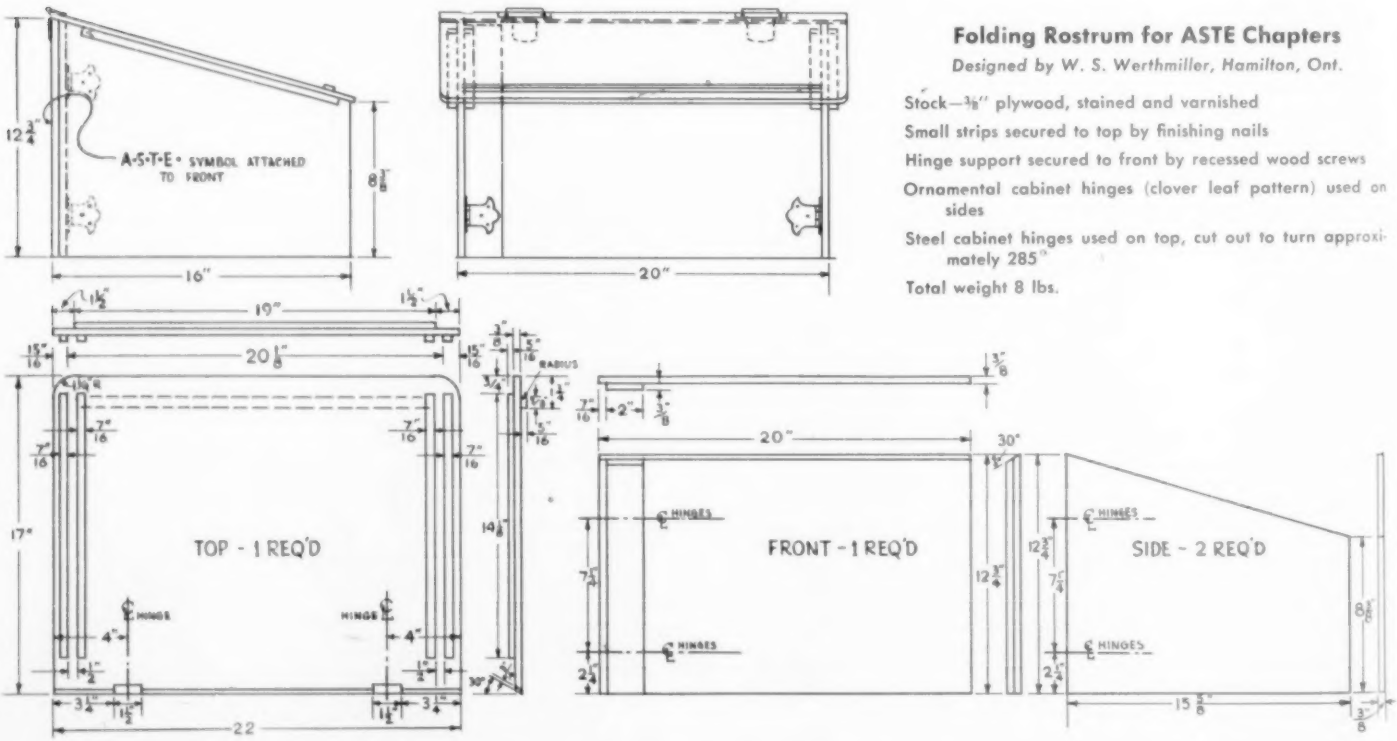
Points Examined During Processing

Systematic planning makes it possible to examine the cutting points of small tools while the heat treatment proceeds. Correlation of tool tip structure and cutting performance was illustrated with slides.

Mr. Weldon related the manufacture of hack saws from raw steel to finished product, including comparative tests of saws made from various materials and a brief explanation of methods used and means of recording performance tests.

The second speaker, M. J. Radecki, Superintendent of the Thompson company, talked on mechanical aspects of the subject, such as feeds and speeds of power hack saws and band saws for various materials; design of blades, cutting teeth and set, as well as the use of tentiometers and torque wrenches for tightening blades to proper tension.

During the evening J. F. Sargent, J. T. Butler and F. O. Uihlein were elected to serve as a Chapter Nominating Committee for 1947-48.



Folding Rostrum for ASTE Chapters

Designed by W. S. Werthmiller, Hamilton, Ont.

Stock—3/8" plywood, stained and varnished

Small strips secured to top by finishing nails

Hinge support secured to front by recessed wood screws

Ornamental cabinet hinges (clover leaf pattern) used on sides

Steel cabinet hinges used on top, cut out to turn approximately 285°

Total weight 8 lbs.

Drilling and Boring Tools

Installment No. 9 of a Series

CONTINUING WITH DRILL JIGS, we show an application of a bushing installation (Fig. 1) used when a drilled hole is to be followed by a tapping or reaming operation. The drill bushing is mounted in a receding cage, and enters a bushing in the jig, which is of sufficient I.D. to clear the next tool. An application is shown in the 2-station fixture, Fig. 2, where a part is first drilled in one of the two spindles of a 2-spindle drill press, and then moved to the other spindle for tapping.

The fixture shown is subject to a variety of applications, and therefore deserves considerable study. For one thing, it is easy to load and unload since, when the operations are completed, it is only necessary to retract the plunger when the part drops onto the chute and from there to an accumulation shelf. With the air motor shown, for station to station traverse, it can be made into an automatic cycle operation by installing an air motor on the spindle as well.

Or, one can move the fixture with a foot treadle, using a spring sash balancer to bring it to a stop under either spindle. Then, by providing a skip-stop, so that it can slip by one spindle, the plunger can be made to recede automatically, when the part becomes self ejecting. The method also lends itself to multiple spindle drilling operations.

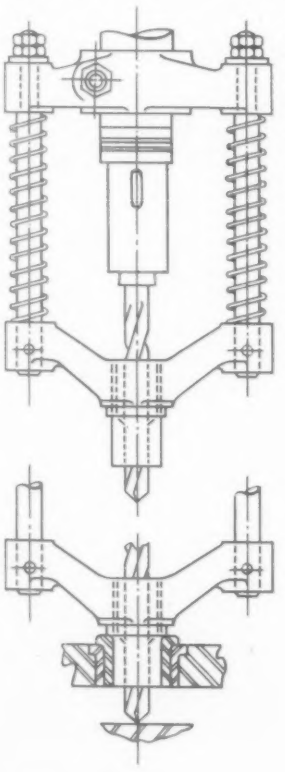
In Fig. 3, we show a method for drilling a number of holes in a large circular ring. The fixture is of the template type, and is incorporated with a radial type drill, the column of which is pressed into a hub which, in turn, is bolted to the fixture. A lifting eye or bail is provided, and the drill head is counterbalanced as shown. The clamps are so designed that they swing clear, when the nut is loosened, and swing under the lip of the work when the nut is being tightened.

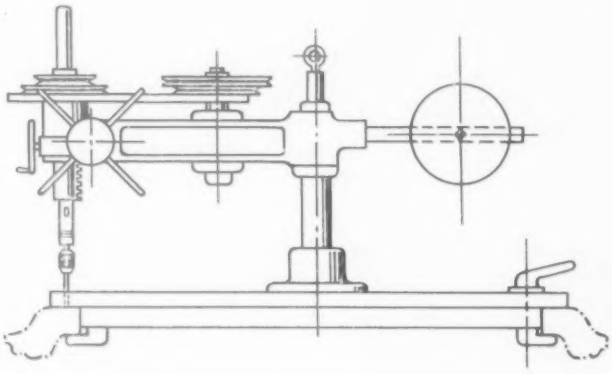
Composite fixtures of this type have been designed to incorporate a second drill head on the opposite side, or even side-by-side. Thus, as soon as a certain number of holes have been drilled, they can be followed by a reaming or tapping operation. In such case, one can incorporate the receding bushing shown in Fig. 1.

As a further application of the receding bushing, to be used where clearance holes are drilled—say 1/16" for a 3/4" screw—one can incorporate a receding locating finger on the drill spindle quill. We then proceed as follows: The first hole is drilled, the drill bushing tending to steady the drill and prevent "walking." Both bushing and pin recede, permitting the drill to complete the hole. On drilling the second hole, the locating finger drops into the first hole and acts as a spacer for the next hole, and so on until all are drilled. There will be some accumulated error although if care is taken with the location of the finger, this should be compensated for by the original 1/16" clearance.

In Fig. 4 we have a drill jig designed for use with a multiple spindle drilling machine. In this design, the combination of machine and jig will automatically drill and index from a push button start to the complete drilling of the part (two parts in this case). After the last stroke, the head rises to a high point for unloading, and loading for the next cycle.

A track cam, on the right hand side, controls the movement of the work slide from right to left, and vice versa. The air cylinder on the R.H. side works in conjunction with





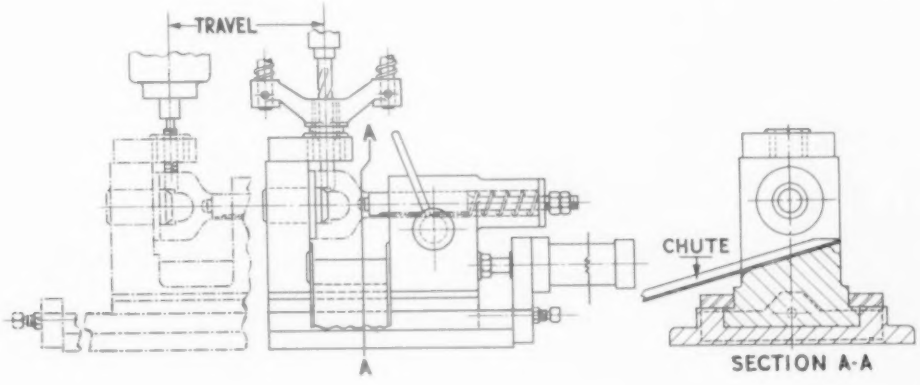


FIG. 1, at LEFT; FIG. 2, BELOW; FIG. 3, at RIGHT.

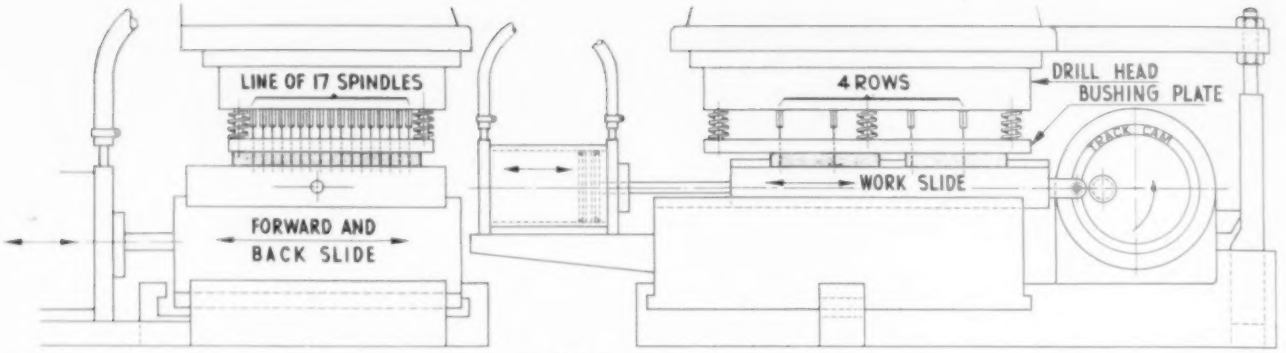
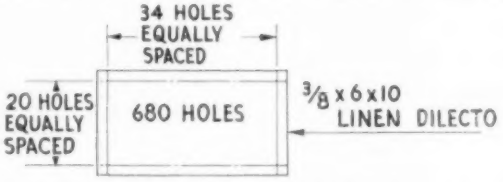


FIG. 4.

Figs. 4 and 5 are by courtesy of *International Business Machines Corporation*, Endicott, N. Y.



the cam and does the actual work of moving. When the cycle is half completed, the air reverses at the same time the cam reverses. Coincidentally, the forward and back slide operate, and index the work slide one space.

The last half of the cycle starts, and an equal number of holes are drilled as were drilled in the first half cycle. The track cam allows the work slide to move one space after each stroke, the last stroke excepted. In the fixture shown, the fixture is indexed laterally 10 spaces. After the last stroke, both slides come back to their original position.

Now, referring to Fig. 5, we have a box type jig with bushings in the cover and also in the three sides. Trunnions are provided at each end, and these fit into bearings in the car. The car is provided with ball bearing wheels which roll on the two outside tracks, suitably located in the base, and is guided by a hardened and ground bushing, sliding on a hardened and ground guide bar. Thus, the car is easily traversed, front to rear.

The car is stopped, front and back, by adjustable stop screws. These locate the car in the proper position for the several drilling operations, and oilers and felt wipers keep the tracks clear of chips, and also lubricate the wheels. It may be remarked that the base can serve for carriage type fixtures which may be interchanged for various jobs.

As shown, this fixture travels from the front bank of the drilling machine to the rear bank, and the fixture is manually indexed for drilling the several series of holes. Of interest in connection with the design, is that the fixture can be tilted forward to the most advantageous angle, for loading and unloading.

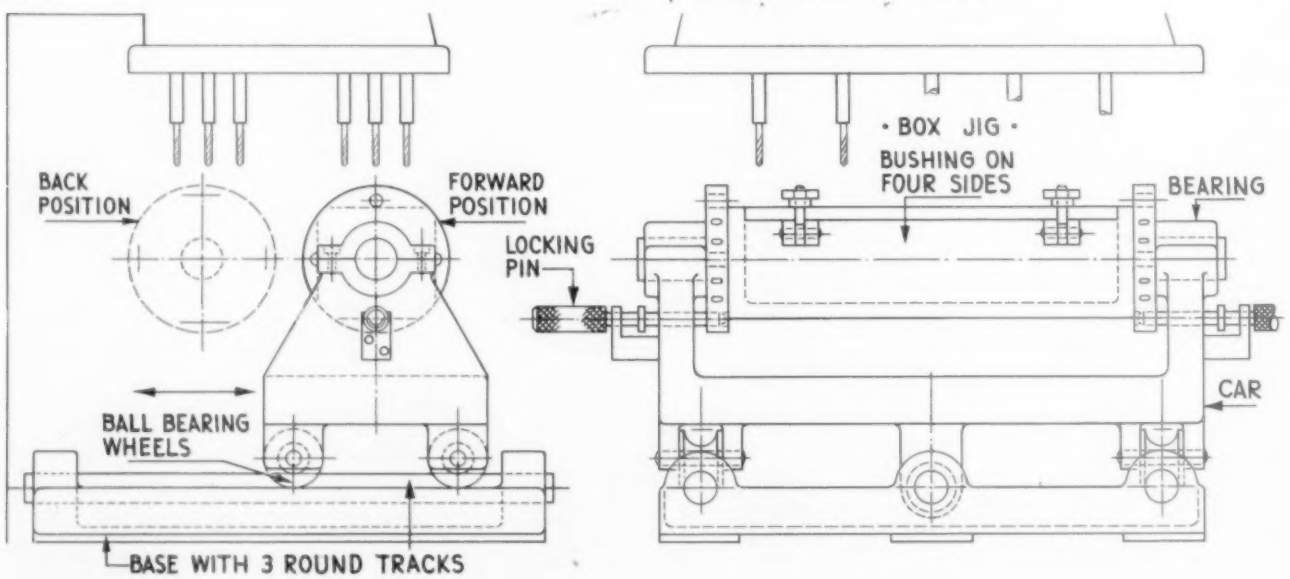
Now, reviewing the fixtures shown in Figs. 4 and 5, it will be noted that the work in Fig. 4 (in this case flat plates) is clamped by spring pressure between the bushing plate and the work slide, and located laterally by the locating strips. While not shown, a strip at the rear acts as a stop. Such location and clamping is entirely practical in a case of this nature, where the several drills tend to keep the workpiece from "walking" away from the drill points, as might be the case were a single drill used. And, since the thrust is all downward, the spring clamping is entirely adequate.

Both designs are infinitely variable. For example, the fixture in Fig. 4 could be aligned on a single guide bar, provided that the guide bushings are spaced far enough apart to prevent side sway or "wiggle." The ends, to prevent rock, could, in turn, slide on hardened and ground wear strips, thus doing away with the wheels and track. An air cylinder could be used to traverse the fixture, from front to rear station and vice versa; and, if one so desired, an automatic indexing mechanism could be incorporated. However, there are practical limits to automatic devices, and here we show fundamentals rather than the more involved mechanisms.

Except for later review, this concludes that part of the series dealing strictly with drill jigs. Starting with the next installment, we will discuss the tools and machines used for precision boring.

End of Part 9. Installment No. 10, this series, will follow in May issue, The Tool Engineer.

FIG. 5.

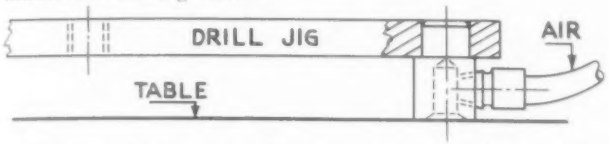


GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

How to Move Large Drill Jig

THE GADGET SHOWN is designed to move a large drill jig, as from one spindle to another in a gang drill, or from hole-to-hole on a single spindle drill press. As operators have reason to know, moving a heavy jig is laborious, and the method shown, which has been used by the writer, makes the moving easier.



The four jig feet are drilled, countersunk and tapped for air connections. One line of copper tubing connects all four feet, with one foot tapped for air hose connection. The air is regulated by a foot operated valve. When air is admitted to the jig feet, the pressure tends to raise the jig, which then slides on a "cushion of air." The film of oil, on the table, tends to act as a seal. When located under the next hole, the air pressure is relieved and the jig "stands put" until moved again.

E. E. Woodman
Bell Aircraft Corp'n.
Niagara Falls, N. Y.

To Measure Between Walls

AN EXCELLENT KINK for obtaining the exact distance between two walls or objects is shown in the accompanying sketch. Take a bar of flat cold rolled steel, and make it to an exact length—as 36", 48", or as desired. Several bars could be made, to serve as a set.

Make one end of the bar square, the other slightly curved or spherical. That will be the gage end. Then take a graduated rule—24", 36" or what have you—and put the two together as shown. Slide outward until the ends contact the desired limitation points, and clamp the two together.

Knowing the length of the bar, it is then only necessary to add the reading on the scale to ascertain the distance. This simple method is decidedly better than "cut and try" methods and will prove to be a time, material and temper saving "gadget."

W. F. Schaphorst, M.E.
Newark, N. J.

Taper Hole Size Gage

WHILE THE IDEA is as "old as the hills," having been used by jewelers for gaging finger rings for many decades, the gadget shown is nevertheless useful for superficial checking of holes.

As adapted to mechanical uses, the gage is graduated, by rings, in increments from $\frac{1}{8}$" to 1". It can be made of tool steel, hardened; or of mild steel, carburized and hardened. In either case it is ground. Care should be taken, in grinding, so that the taper will exactly coincide with the graduations.

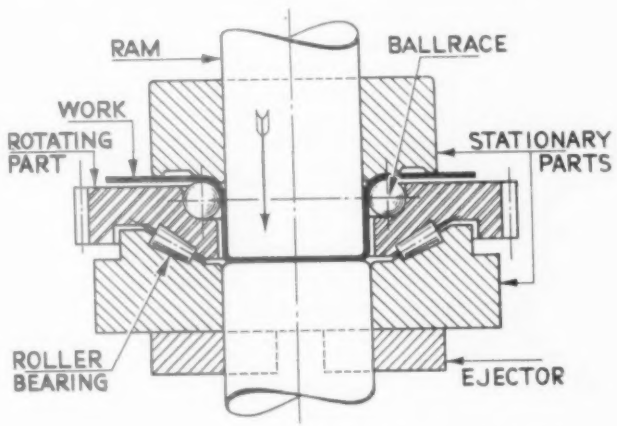
While shown with annular graduations, the tool should be divided one side only. Graduation can be done on the lathe by offsetting slightly in the chuck and scoring with a sharp tool—deep enough so that the marks will not grind out. By scoring one side only, the gage will not catch in a hole.

Frank J. Peragine
Greater N. Y. Chapter, A.S.T.E.

Deep Draw Die

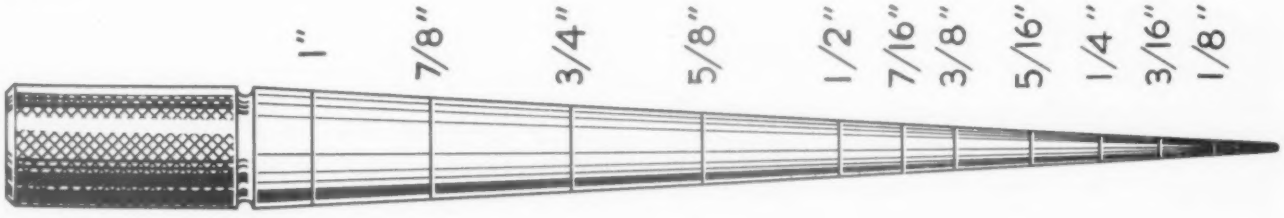
THE "GADGET" SHOWN should permit deeper drawing, in one operation, without annealing. By use of a suitable cooling system, it could be advantageously used for hot work as well. Operation is as follows:

The "die" is two-piece and constructed after the manner of a taper roller bearing. The die proper is provided with gear teeth on the periphery, and is made to rotate by means of an independent driver, or by means of a gear which may be actuated by a very coarse pitch screw attached to the ram—much after the fashion of a reciprocating egg beater.



The rotating die tends to "spin" the part to shape, and the balls will prevent scoring, the while the metal is rolled. The part will turn somewhat slower than the die, the speed of which must be determined by trial. However, the method should result in a higher production than one may expect from a conventional die.

W. Palmer
Toronto Chapter, A.S.T.E.



BULLETINS AND TRADE LITERATURE

Items briefed herein have been carefully selected for their interest and application. Unless otherwise stated, all are available, free, from the stated sources.

NAT'L TOOL SALVAGE CO., 6511 Epworth Blvd., Detroit 10, has issued a 20-page *Carbide & High Speed Tool Salvaging Catalog* outlining improved facilities now available for carbide re-salvaging of milling cutters, drills, reamers, counterbores, spotfacers, centers, and special cutters of all types in the side and end cutting catagories, as well as centerless grinder rest blades.

O'NEIL-IRWIN MFG CO., 375 8th Ave., Lake City, Minn., has issued a 40-page catalogue, *Di-Acro System of Die-Less Duplicating*, presenting their regular line of equipment, and especially emphasizing ten new features of their recently redesigned Di-Acro Brake.

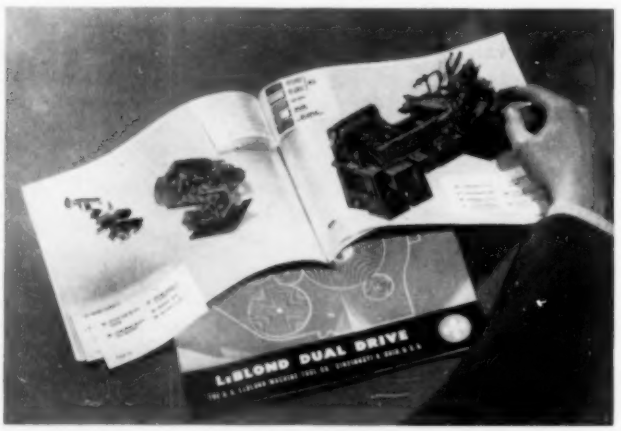
Bulletin 215, by **HAMMOND MACHINERY BUILDERS, INC.,** 1600 Douglas Ave., Kalamazoo 54, Mich., presents the Hammond Model CB-77 Chip Breaker & Diamond Finishing Grinder—a new dual-purpose machine, built to handle chip breaker grinding and diamond finishing on both a precision as well as a production basis.

GAUGE & TOOL MAKERS' ASS'N, Standbrook House, Old Bond St., London, W. 1, England, has released a new *Export Catalogue*, listing precision tools and gauges now being manufactured for overseas export by 200 British member-firms.

ACCURATE SPRING MFG CO., 3811 W. Lake St., Chicago 24, announces publication of their 36-page *Handbook of Technical Data on Springs*, offering information on such subjects as design formulation, load deflection and the proper methods of specifying springs.

TABER INSTRUMENT CORP'N, 111-TE Goundry St., N. Tonawanda, N. Y., present, via *Bulletin No. 4506*, their V-5 Stiffness Gauge, which is a portable, precision-type testing instrument for calculating stiffness and resilience in sheet metal, laminated plastics, and other materials up to ⅛" thick. The gauge translates results into certified standard values on an accurate, reproducible basis.

So different that each page brings a new surprise, a "silent salesman" bulletin, *LeBlond Dual Drive*, by **R. K. LeBLOND MACHINE TOOL CO.,** Cincinnati 8, O., uses the Trans-vision process, and permits the reader to disassemble and assemble the Dual Drive Lathe piece by piece, pictorially, right at his desk. A release on this machine appeared in "Reviews and Previews," December '46, *The Tool Engineer*, and, although this bulletin does cost 81 per copy, it's worth it, if only for the inspiration! It certainly sets a new high in the constantly improving quality of advertising literature.



NAT'L AUTOMATIC TOOL CO., INC., Richmond, Ind., has released *Circular No. 145-57*, showing how automatic handling methods can be improved with NATCO Automatic Processing Machines which speed productive capacities of both machine and operator. Actual case studies are included in this attractive 28-page booklet.

PLASTICS DIV'N, *American Cyanamid Co.*, 30 Rockefeller Plaza, New York, N. Y., has issued a bulletin, LAMINAC *Resin*, delineating use of this polyester resin as a sealant for porous metal castings which must be pressure tight.

LINCOLN ELECTRIC CO., Cleveland 1, Ohio, has prepared a 32-page booklet, *Learning to Weld*, explaining basic principles of arc welding, as well as how to repair broken parts, build equipment, and hard-surface worn parts. Price postpaid in U.S.A. 25c, elsewhere 35c per copy.

Centri-Merge Spray Booths, an 8-page folder by **SCHMIEG INDUSTRIES, INC.,** 329 Piquette Ave., Detroit 2, is devoted to a description of the Centri-Merge method of eliminating offspray by a curtain of falling water.

SIZE CONTROL CO., 2500 W. Washington Blvd., Chicago 12, has a 20-page *Gage Catalog*, devoted to its gages and measuring wires, data on salvaging of surplus gages, and details on the company's new centerless lapping machine.

SCHMARJE TOOL & ENG'G CO., Muscatine, Iowa, describe their line of standardized design carbide tipped tools in *Catalog No. 146*.

BURG TOOL MFG CO., 6709 S. San Pedro St., Los Angeles 3, Calif., has a folder, *"Tool-Flex"—Flexible Tool Holder*, presenting advantages of their Neoprene mounted, positive drive, flexible tool holder.

Blanchard Wheels, the most recent leaflet by the **BLANCHARD MACHINE CO.,** 64 State St., Cambridge, Mass., explains the best type of wheel to use with Blanchard Surface Grinders, on a varied assortment of work.

A new free machining die steel, called *Speed-Cut*, is described in a recent booklet by the same name, available from **VANADIUM-ALLOYS STEEL CO.,** Latrobe, Pennsylvania.

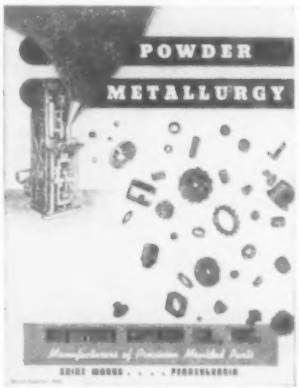
D. A. STUART OIL CO., LTD., 2727-49 S. Troy St., Chicago 23, has available *Technical Bulletin No. 5*, entitled "Cutting Fluids & Coolants," a 36-page symposium on cutting fluids originally presented at the Cleveland New Era Exposition, A.S.T.E., and subsequently published in the July, 1946, issue of *The Tool Engineer*.

SIGNAL ENG'G & MFG CO., 154 W. 14th St., N. Y. 11, has a 20-page *Catalog No. 6* ready for distribution, which deals with small power relays and medium power relays. Data is included on the method of selecting relays, on operating characteristics, contact circuit arrangements, and there is also pertinent information on contact ratings.

GOOD READING

A Guide to Significant Books and Articles of Interest in the Trade Press

POWDER METALLURGY, a 44-page booklet available from the *Keystone Carbon Co., Inc.*, Saint Marys, Penn., is essentially a catalog of that company's line of powdered metal parts, including bearings; but it contains so much interesting information that it also makes for considerable "good reading."



Beginning, by defining powder metallurgy as "... the science of converting metals to powders, and/or processing metal powders into finished parts," the booklet goes on to list a total of 86 applications in which powdered metal parts have been successfully used: (1) in production equipment, such as cams and gears; (2) aviation equipment, such as landing gear bearings, and turret bearings; and (3) automotive applications including water pump washers, clutch pilot bearings, and gear shift lever bushings.

The next section, called "Designers' Aid Section," lists limitations of powder metallurgy, stressing that the method is primarily a process for large volumes; that tolerances should be liberal; and that internal and external threads cannot be molded, but must be machined by an extra operation. This is followed by a section devoted to design styles and specifications for sleeve, flanged, profile and intricate shapes.

TRADE-MARK ACT OF 1946, a book written by H. A. Toulmin, Jr., Dayton, Ohio, explains the Lanham Act, the first comprehensive law enacted for the protection of trademarks in the United States. A unique feature of the trademark law is the provision for separate register. In addition to the principal and supplemental registers, the Commissioner of Patents may establish separate registers for foreign marks, service marks and collective and certification marks.

One of the most vital features of the new trade-mark law is that after a period of years a mark becomes incontestable and is the property without question of the owner. New grounds for cancellation are if the mark becomes the common descriptive name of a product, or if the mark is being used to violate the anti-trust laws. Price per copy is $5.00, from the publishers, *W. H. Anderson* of Cincinnati, Ohio.

MACHINE-SHOP ESTIMATING, a 486-page book by W. A. Nordhoff, Machine-Shop Estimator at Douglas Aircraft Co., Inc., provides a scientific basis for weighing the performance of machine shop operators, by explaining how to arrive at an estimate of the *time* it should take to perform any given job in a machine shop.

After several introductory chapters on such subjects as, "The Machine-Shop Estimator and His Function," "How to Make Tables and Use Them," and "What Goes into an Estimate," the author takes up the various fundamental machining elements, such as turning, boring, facing, threading and tapping. He defines each, and shows how one basic formula is used in a great number of cases. This formula is used for finding the time involved to perform a given machining operation: time involved being equal to length of cut in inches, divided by the product of revolutions per minute, multiplied by feed, the latter in inches per revolution; or, $T = L/(rpm \times F)$. Sample problems have also been worked out at the end of many of the sections.

The author spent over 15 years gathering and testing this data; and throughout the book he has attempted to give time values that represent fair averages. Whenever a choice of values might appear possible, however, he has selected one value, making for consistency in the estimating procedure.

An estimator, in the opinion of the author, should be a highly skilled and versatile individual. Specifically, he should be qualified ". . . . to make time and motion studies, evaluate methods of operation, outline from blueprints all the necessary steps in the manufacture of a product, recommend proper tooling and production aids, and place a reasonable time value, or cost, on the job." That, in essence, is Mr. Nordhoff's considered definition of an estimator.

Writing on the *aim* of the estimator, he says, "The aim of the estimator or the time-study man is to set a standard which approximates the time in which a normally efficient machine operator should complete an operation."

As for what should be charged against any one job, Mr. Nordhoff writes: "Every move the operator makes, every cut made by the machine, every cutting tool that must be resharpened or replaced periodically during the machining of parts, all personnel and fatigue allowances consume time and must be charged against the job."

In addition to defining such terms, and discussing all basic machine operations, and the various methods of estimating the time required to fabricate machined parts, the author has made up tables to supply machinery elements which are generally variable. Also, sample estimates are shown for all machine operations, all of which should go a long ways towards enabling the reader to do his own estimating.

The book is available from *McGraw Hill Book Co., Inc.*, 330 W. 42nd St., New York 18, at $6 per copy.

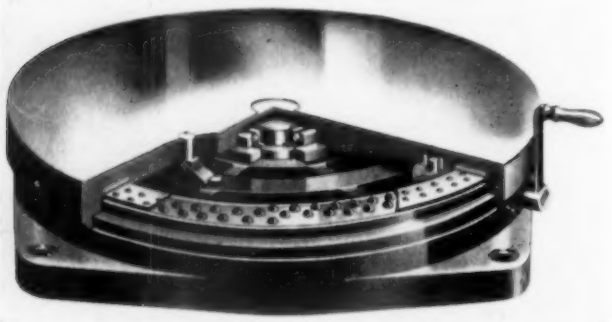
TECHNICAL ADVISOR, a monthly technical paper, made up in attractive format, and just launched by Reynolds Metals, is designed to publicize latest recommendations on how to use aluminum mill products most effectively. Vol. 1, No. 1 carries a condensed technical description of the two main processes in the production of aluminum—the Bayer process of producing alumina from bauxite, and the Hall method for reducing alumina to metallic aluminum.

Another feature of this 4-page issue is the technical process study which will be continued serially; the current article being devoted to the welding of aluminum, including such factors as weldability of the aluminum alloys, application of gas welding, and edge preparation for gas welding. The periodical is sent free upon request to Technical Editorial Service, *Reynolds Metals Co.*, 2500 So. Third St., Louisville 1, Ky.

TOOLS OF TODAY

Rapid Index Table

THE *Robbins Engineering Company*, 318 Midland Avenue, Detroit 3, announces the new Robbins **INDEX TABLE** for fast, accurate indexing on a wide variety of production operations. Table index is manual, and is accomplished by turning the crank handle to horizontal. This disengages a large diameter locking pin, and as the table is indexed the handle is released and the table is locked in the next position automatically. The number and location of the index positions are determined to suit the application.

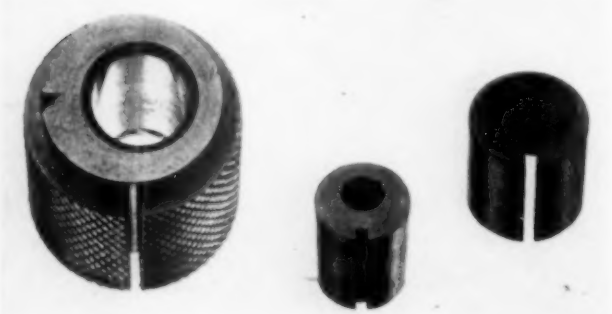


The index table is fully supported by a large, specially designed ball bearing which, it is claimed, eliminates out-of-parallel conditions due to vertical thrust from cutting tools or heavy parts located off-center on the table. Special design of the support bearing also prevents brinelling of the races. An anti-friction radial mounting produces effortless indexing and reduces operator fatigue; and a safety stop permits indexing in one direction only.

The index table and base are ribbed for extra strength, and all wearing parts are hardened and ground for maximum life and are concealed from dirt, chips and abrasives. Complete details are contained in a fully descriptive bulletin.

Drill Bushing "Blanks"

A NOVEL LINE OF **DRILL BUSHINGS,** by *Conex Products*, Box 629, Glendale, Calif., employs the double eccentric principle to insure accurate location in a drill jig. That is, both liner and bushing are made eccentric and one or both may be rotated to provide adjustment from dead center to 1/16" off center. This feature is especially advantageous when, lacking a jig borer or other precision boring equipment, jigs have to be made with available equipment. Full information regarding these novel drill bushings may be had from the maker.



New Ram-Type Miller

THE NO. 22M **RAM-TYPE MILLING MACHINE,** especially designed for use in pattern shops, tool rooms, die shops and laboratories, is announced by the *Van Norman Company*, Springfield 7, Mass. The new machine incorporates an adjustable cutterhead mounted on a movable ram, a feature that permits an operator to perform any type of conventional milling from horizontal through angular to vertical.

In addition to this feature, an outstanding advantage is the higher column, which provides greater vertical range. Table is 50" x 10", longitudinal range 28", cross 10" and vertical 20", with front and rear directional controls to all power feeds, with provision for locking any feed in neutral. The machine, which like all Van Norman millers is built to precision standards, may be had with either plain or universal saddle.

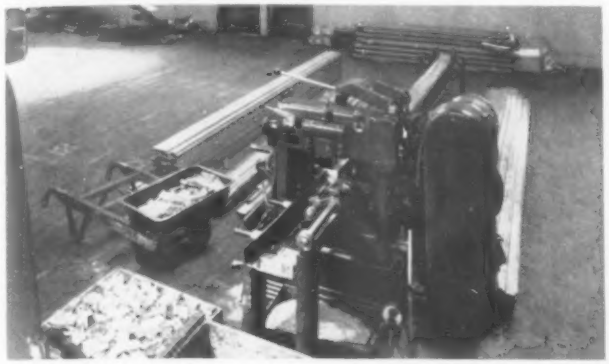
New Photo Printer

A NEW **PHOTO PRINTER,** for blue or black line prints, is announced by *Foster Sales Co.*, 4200 Woodward Ave., Royal Oak, Mich. The Foster Printer, which makes crisp prints in sizes up to 24" x 18" in less than 5 minutes, operates with inexpensive photoflood bulbs, has a closed compartment in the base for holding the paper and is inexpensive to buy and operate.

The Foster is designed to supplement the regular blue print equipment in the larger plants, by having print making facilities scattered through the plant at places where prints can be secured in a few minutes. It handles prints from paper or cloth tracings, printed or typewritten sheets or handwritten copy.

Full Automatic Metal Sawing

AUTOMATIC PULL-UP, and automatic gaging in lengths from ⅛" to 48", are made possible through the development of a mechanically controlled **POWER SAW**—the Mechani-Cut—just announced by *Peerless Machine Company*, Racine, Wisconsin. Faster and more accurate sawing is claimed for this metal sawing improvement.



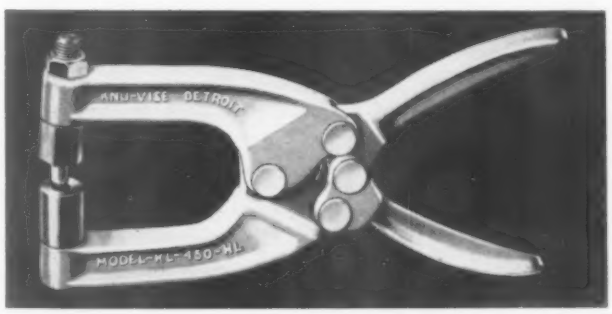
Metal is fed forward within a four-sided saw frame assembly which completely surrounds the work as the metal is being cut. A multiple bar-clamping vise releases and sets automatically; and when the cut is completed, the conveyor feeds the pre-determined length of metal into the saw.

In case of accident or blade breakage, a micro-switch—for blade safety—automatically stops the machine. When the last remaining stub of metal on the conveyor—single bar, a nest of bars, billets, tubes or squares—contacts the limit switch, the cycle automatically stops.

A new mechanically controlled conveyor is built for the Peerless Mechani-Cut model in 7" x 7" and 11" x 11" sizes. A 14" Mechani-Cut is supplied only with a manually-operated conveyor. The equipment is fully described in the new Peerless Machine Company bulletin, MC-51-A, now available.

Hole Locator By Knu-Vise

BY MEANS OF A new **HOLE LOCATOR**, announced by *Knu-Vise, Inc.*, Detroit, several sheets of metal can be quickly aligned to position them for riveting, spot welding or drilling.

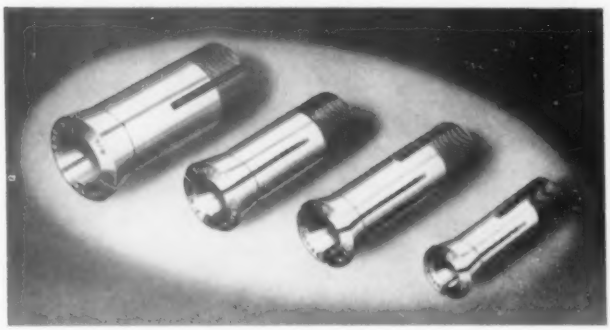


The new device looks like ordinary pliers and operates as simply. Characteristic of all Knu-Vise pliers, this model—catalogued as KL-450-HL—has a toggle-action which automatically locks upon the work held, leaving operator's hands free to perform other work. An easy motion separates the handles, to release the pliers.

The pressure spindle can be adjusted to admit work up to 1¼" thick with locating pins available in all popular diameters. The Hole Locator is 8" long and 3" wide, and is capable of holding a maximum of 500 pounds. It weighs 22 ounces. An actual sized template will be supplied on request.

Brass Collets

A NEW LINE of precision **DRAW-IN COLLETS**, made of brass, is announced by the *South Bend Lathe Works*, South Bend 22, Ind. Although not intended to replace the more expensive hardened steel collets, they are manufactured to the same exacting tolerances and have some advantages—as, for example, low cost which makes them especially desirable for occasionally used odd sizes. However, they are claimed to give good service and can be used for short run production jobs. When worn, they can readily be re-bored to a larger diameter. Another advantage, of brass collets, is that they can also be machined for holding tapers or irregular shapes.

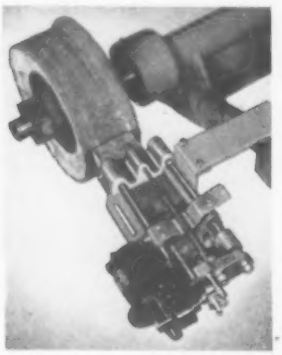


These collets are made in standard fractional sizes, from 1/16" up to the maximum capacity, in increments of 1/64". They are also available with decimal hole sizes for any diameter between .0625" and the maximum capacity of the collet. Collets with metric hole sizes are supplied in increments of ½ mm, any size between 1.5 mm and the maximum metric collet capacity.

Designed primarily for use with South Bend Lathes, these collets are available in four styles and can be purchased for use with any machine which they will fit. Complete information and specifications may be had in Bulletin No. 83 from the South Bend Lathe Works, 417 E. Madison Street, South Bend 22, Indiana.

Buffing Compound Applicator

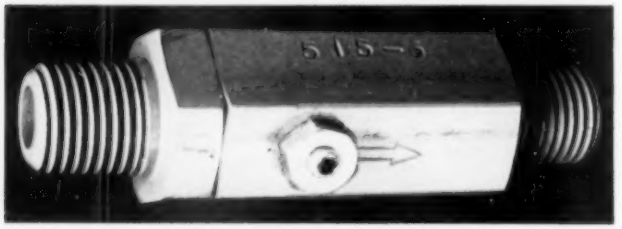
A NEW **BUFFING COMPOUND APPLICATOR**, that provides intermittent feed control operating at the rate of 14 strokes per minute and affords a feed ranging from .0015" to .015" per stroke, is announced by the *George L. Nankervis Company*, 5442 Second Blvd., Detroit 2. The applicator can be mounted on any automatic machine, either right or left-hand, and can be adapted to everything from simple to complex multiple-stage buffing operations.



It is driven by a totally enclosed geared head motor with 110, 220 or 440 volts as required. The quick action compound applicator clamp, with adjustable features to compensate for variable thicknesses and standard carrier, will accommodate any length stick of compound up to four inches. Special carriers for wider cakes are available. Light weight—total only twenty pounds—permits adaptation of floating heads without disturbing balance. Compared to feeding by hand, this automatic method of applying the compound will effect savings upwards to forty per cent by making practical: (1) Savings in compound; (2) improvement of the quality and uniformity of the work; and (3) speeding up the job.

New Speed Control Valve

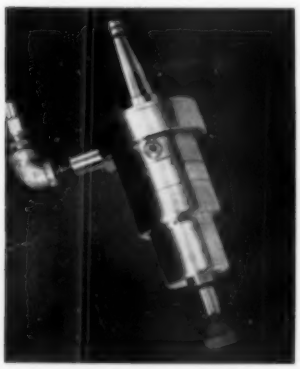
A NEW **SPEED CONTROL VALVE,** basically a standard Electrol check valve, but incorporating a new metering device, has been developed by *Electrol, Incorporated*, Kingston, New York. As announced by Benjamin N. Ashton, President, this latest addition to the extensive line of Electrol hydraulic devices has attracted considerable attention because, while allowing free flow in one direction, it precisely controls the flow in the opposite direction by means of a metering pin, rather than by regulation through the main orifice. This rate of flow in opposite direction can be changed to suit individual installation by the adjustment of the screw-actuated metering pin, set in one of the hexagonal sides.

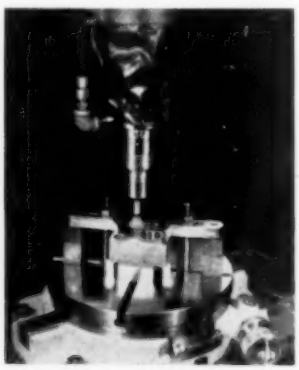


This device assures "pin point" control, and eliminates the chances of error inherent in conventional designs because of the much smaller control area involved. The valve, which is furnished in $\frac{1}{8}$", $\frac{1}{4}$", $\frac{3}{8}$" and $\frac{1}{2}$" NPT port sizes, has the additional advantages that it is compact in shape (which is straightline, with only one small protuberance) and that it can be used with pressures up to 1500 psi, and even higher, if desired. It can handle air, oil and water, at both high and extremely low pressures.

Precision Grinding Attachment

A HIGH SPEED air-driven attachment—called the Vulcanaire—which quickly and economically converts jig borers and other machine tools into **PRECISION JIG GRINDERS,** is now available from the *Vulcan Tool Co.*, Dayton, Ohio.



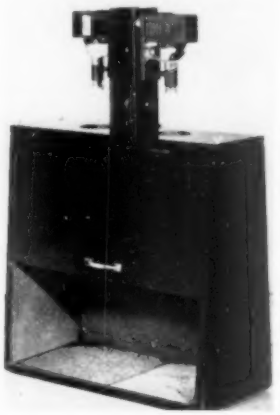


The Vulcanaire, which is equipped with an adaptor that fits into the chuck of any machine tool when the operation requires precision jig grinding, has controllable speeds ranging from 30,000 to 75,000 rpm. From four to eight cubic feet of air per minute is all that is required for the complete speed range. The unit is $2\frac{1}{2}$" in maximum diameter and, exclusive of adaptor and grinding wheel, is $7\frac{1}{2}$" over-all. Precision grinding of holes from 1/16" to $1\frac{1}{2}$" can be accomplished. The complete unit, which is to be priced below five hundred dollars, includes adaptor to fit any specific machine tool, together with dust collector, air filter, pressure gage and oiler. In addition to jig grinding applications, the Vulcanaire is produced in models for adapting lathes, milling machines and internal and surface grinders for other high speed precision grinding.

New Inspection Instrument

MACHINED FINISHES are easily controlled by a new portable **FAXFILM DUAL PROJECTION UNIT,** Model D-30, introduced by *The Faxfilm Co.*, 1220 W. Sixth St., Room 576, Cleveland 13, Ohio. This instrument provides a quick, accurate comparison of a production finish with a standard finish and, in addition to flat surfaces, may be used for curved and conical shapes, as well as inside or outside diameters.

Weighing only 27 pounds and requiring but two square feet of bench space, and therefore easily portable, the instrument may be set up at inspection point inside of two minutes.



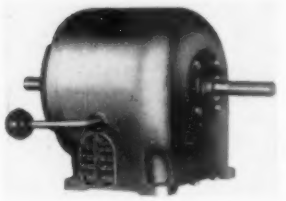
Faxfilm is the process by which a plastic replica of a surface is made, in less than a minute, and projected in a micro-projector to produce a three-dimensional image of the surface at from 10 to 200 diameter magnification. In this new unit, however, Faxfilms of a standard finish (norm) and of a production finish are projected by two micro-projectors mounted at the top of the case, the images appearing side by side at 30 diameter magnification on a screen at the base of the case.

Openings on either side of the case permit the operator to view the images, to measure them or point to specific areas during a discussion. Wollensak 1" f:2.46 lenses provide excellent definition of minute surface irregularities to show the differences, between the standard and the work specimen. Rheostats for each projector equalize the intensity light for greatest accuracy in comparison. Higher magnification is obtained by turning the projectors to project horizontally on a wall or screen, one diameter of magnification being obtained for each inch of projection distance. The unit may be used on 110-120 volt ac or dc. The unit is fully described in literature available from the maker.

Selective Speed Drive

A NEW ADDITION to their line of **SELECTIVE SPEED GEARSHIFT DRIVES,** by *The Lima Electric Motor Company*, 401 Findlay Road, Lima, Ohio, and identified as Type RD, is designed to motorize machinery requiring selective speeds, and can be used with any standard motor of $\frac{1}{4}$ hp to 1 hp rating.

Gear ratios of the new Type RD are 1 to 1, 1.33 to 1, 2 to 1 and 4 to 1; and speed changes occur in even steps.



The Type RD is a 4 speed transmission, similar in design to that used on direct motor-driven Lima Gearshaft Drives and features many noteworthy design principles. A unit cast gear box provides permanent alignment; and highly efficient gears and bearings, adequately lubricated by a permanent oil bath, assure long trouble-free service.

The shift lever is available in four optional positions. A conveniently located speed selection chart facilitates selection of output speeds. The Type RD will operate in either direction of rotation. Comparatively small in over-all dimension, the unit is especially adaptable to applications where mounting space is limited.

Precision Radius Dresser

An ingenious simplification in radius dresser setting, which drastically cuts setup time required for grinding wheel dressing, is provided by the new "Universal" **PRECISION RADIUS DRESSER** made by *Universal Vise and Tool Company*, Parma, Michigan. This radius dresser is easily set with gage blocks, inside micrometer, height gage or planer gage, allowing less skilled operators to achieve maximum machine accuracy. Radius precision is limited only by the accuracy of the setting device, with which tolerances as small as .0001" are easily maintained.

This new dresser produces convex, concave and compound radii from 0" to 1" on wheels up to 7" diameter. It can be held either vertically or horizontally on a magnetic chuck. Frame and arbor are of cast iron for utmost rigidity and lasting accuracy.

New Electronic Grinder

The Rogers electronically driven type NT-20 **FACE GRINDER & KNIFE GRINDER** is said to be the first machine of its kind to feature adjustable speed accurately controlled by a simple, finger tip device. This new concept of precision grinding, exclusive with *Samuel C. Rogers & Co.*, 191 Dutton Ave., Buffalo 11, N. Y., is achieved through an electronic panel, complete with rectifiers and their supporting tubes and circuits.

This versatile grinder can be easily controlled by even an inexperienced operator. A single finger tip dial, on the front of the machine, permits speed changes within the range of 5 ft. to 70 ft. per minute while the machine is running. The electronic drive allows the operator to select exactly the right speed for each kind of work—slow traverse for heavy cuts, or fast traverse for light cuts with high finish. Work quality is improved because the electronic drive not only provides correct cutting speed, but holds it as well, and produces no noise or vibration, and no shock at reversals. The table is 72" long and 16" wide. Grinding is done by a 20" cylinder grinding wheel.

New "Pedrifugal" Pumps

The *Allis-Chalmers Mfg Co.*, Milwaukee, Wis., announces a new line of **"PEDRIFUGAL" PUMPS,** developed at its Norwood Works to meet the needs of an unusually wide range of users who require a sturdy, reliable pump of moderate capacity selling at a competitive price.

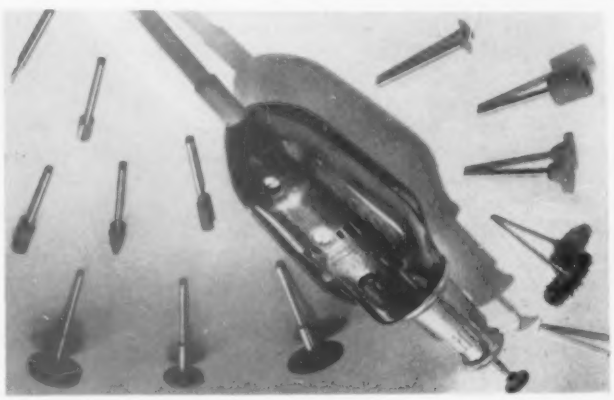
This new line of cast iron bronze-fitted, pedestal-type centrifugal pumps comes in three principal sizes—1" x 1", 2" x 2", and 3" x 3". Capacities are from 10 to 500 gpm at heads from 10 to 100 feet, and with power requirements from ¼ to 15 hp. The units are splatter-finished with gray enamel.

"Pedrifugal" pumps are expressly designed for use with Texrope V-belt drives, giving an infinite range of capacities, regulated by size of sheaves and power supplied. All the pumps are fitted with impellers of maximum diameter, and variations in capacity are provided by changes in speed through sheaves of larger or smaller diameter.

"Electri-Craft" Power Tool

A new **ELECTRIC POWER TOOL**—the Electri-Craft—by *Casco Products Corp'n*, Bridgeport, Ct., is sold with 36 complete accessories, including abrasive wheels, drills, buffing wheels and brushes. With these tools—contained in a large metal kit—the unit is a miniature portable workshop.

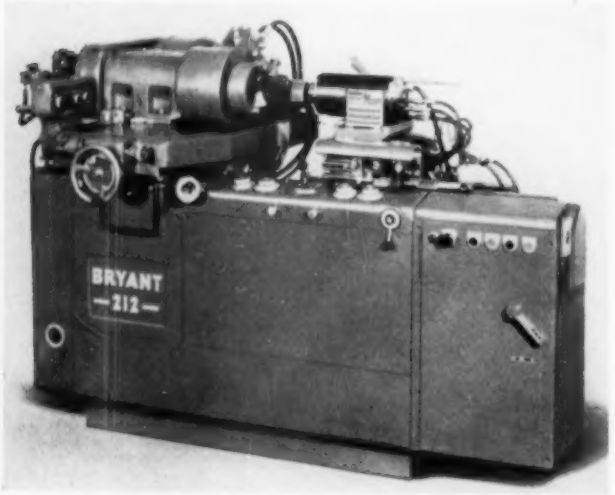
The housing, which is molded in two halves and assembled over a die cast aluminum frame which encloses the motor, is of Tenite, a plastic product of Tennessee Eastman Corporation, Kingsport, Tenn. This material is extremely tough and shatterproof, and is not subject to deterioration from oil or perspiration. Designed to fit easily into the hand, the tool is balanced for "pencil-grip" operation.



Automatic Internal Grinders

DEVELOPED TO FILL the need for a Precision High Production **AUTOMATIC GRINDER,** the No. 212 Bryant is designed so that, where required, one or more machines may be operated by one operator. A product of the *Bryant Chucking Grinder Company*, Springfield, Vt., the Series 212 meets all requirements of modern production—speed, accuracy, fine finish and ease of operation.

Maximum rigidity is provided in this machine by the well-known Bryant cylindrical slide construction. The slide bar, to which the wheelslide is attached, is supported on two bearings in the base of the machine. A shoe beneath the rear of the wheelslide follows a hardened and ground control plate. The wheelslide is thus supported at three points, each of which is provided with pressure feed lubrication.



The machine swings 9" inside the standard water guard and has a 12" total wheelslide traverse. Cross feed is by lateral motion of the workhead which is supported by specially designed roller type anti-friction bearings. The machine is suited for grinding work with bores from 5/16" up to 3½" in diameter, and the grinding traverse permits grinding of 3" bore lengths. For the smaller ranges of bores, Bryant Hi-Frequency wheel spindles, operating up to 100,000 rpm, may be used. In addition, a variety of standard or special tooling may be used in conjunction with the machine to satisfy the particular needs of the consumer.

Machine movements are hydraulically operated to afford operating flexibility between the various units. Cycle control is electrical and the cycle can be readily changed to suit varying working requirements.

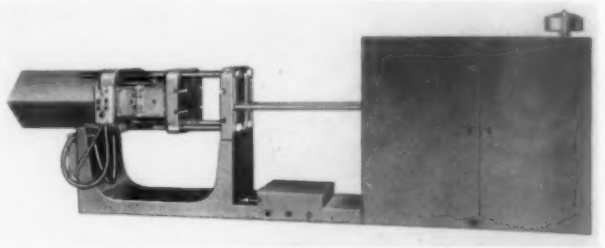
Three methods of automatic sizing can be provided, and the basic machine is so equipped that changeover from one method to another can be accomplished merely by the addition of the sizing equipment. Sizing, from the truing diamond, is effected by pre-determined advance of the wheel beyond its truing position, which is performed between the rough and finish grinding positions of the cycle. Wheel wear is automatically compensated for.

Automatic plug sizing is accomplished by a plug gage, mounted in the work spindle, which automatically checks the bore size after each pass of the grinding wheel. As the plug gage enters the bore, the machine automatically stops grinding and the wheel withdraws from the bore, ready for loading of the next workpiece.

A third method of sizing can be applied wherein a diamond tipped finger, contacting the bore as it is being ground, operates electrical contacts to arrest the grinding action of the machine and to withdraw the wheel from the bore, ready for insertion of the next workpiece.

New Die Casting Machine

THE *H. L. Harvill Manufacturing Co.*, recently removed to their new plant at Corona, Calif., announces a new addition to their line of **DIE CASTING MACHINES.** The new model—HD103—is a high speed cold chamber injection type, with center gate for casting aluminum, magnesium and brass alloys. Provision is made for conversion to hot chamber operation, for casting zinc, lead and tin base alloys. These latter alloys may also be cast as cold chamber die castings; wherein, if so desired, the metal is hand ladled to the shooting cylinder.



The machine is basically a small, light weight cold chamber type capable of casting up to 2.6 lbs. of aluminum, or a proportionate volume of other base metal alloys, at a maximum reduction rate of 500 "shots" or casting cycles per hour. This piece of equipment follows the basic engineering design of the larger Harvill machines, except that it is scaled down proportionately to accomplish high speed, low cost casting of small, to medium sized parts.

Engineering specifications provide for normal die dimensions of 13½" vertical by 23" horizontal, with 10" between dies in the open position; and a maximum thickness of the dies, when closed, of 19 inches. The over-all dimensions are: 2' 8" in width by 12' in length by 4' 6" in height. The die platen size is 19" x 23" over-all. Oversize dies may be used, provided that the cavity area arrangement for the longest dimension be horizontal, and the volume of metal does not exceed the specified maximum. Vertical dimension of dies is limited by the position of the 1¾" tie bars through the die platens. Clearance between the bars is 13¾" vertically by 11¾" horizontally.

The "shooting" or injection piston is 4" diameter, with a 13" stroke. Operating nominally under 1000 psi oil hydraulic pressure, 5000 psi is applied on the molten metal injected into the die cavity. Research has indicated, and actual production experience with the machine has proven, that this metal pressure is ideal for high speed casting. Sufficient pressure is exerted to produce sound castings with high mechanical properties, yet free of galling upon ejection—the latter trouble being generally caused by excessive casting pressure forcing metal into any slight surface irregularity of the die cavity. Complete engineering and production information may be obtained on company letterhead when requested.

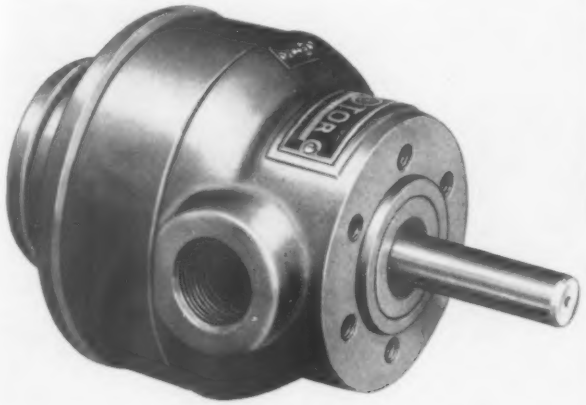
New Quaker Cutting Oil

BECAUSE OF sharp price increases in cutting oils of fat, and sulphurized fat bases, many plants are turning to lower cost products. To meet this demand, the *Quaker Chemical Products Corp'n*, Conshohocken, Pa., has developed the **QUAKER KUT 85,** a honey colored, odorless, low cost base that can be blended with mineral oils to handle all machining jobs wherever a cutting oil is used.

The base can be blended with 100 vis., or 250 vis. oil or kerosene (which are normally stocked) in available tanks, or at the machine, thus simplifying storage and handling, without sacrificing production efficiency. Full information regarding the new product can be had from the manufacturer.

Gerotor HP Hydraulic Pump

A **HYDRAULIC PUMP** of new design, for higher operating pressures, is now available to industry from the *Gerotor May Corporation*, Baltimore 3, Md. Identified as Type QH, this basically improved pump model is already in production, and is offered for early delivery.

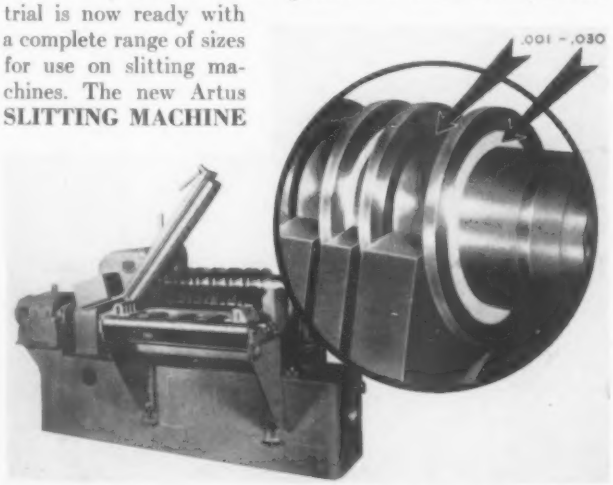


Essentially, pumps in the QH series feature the well-known Gerotor gear mechanism in a stronger, heavier body. Designed for operating pressures up to 1500 psi intermittent, or 1200 psi continuous, the QH series is available in capacities of 3, 5, 8 and 12 gpm, for plain (see cut) base or flange mounting. Performance charts for this new pump series show high volumetric and mechanical efficiency.

Standard design speed for the Gerotor QH pump is 1200 rpm, but applications at other speeds are also practical. Standard rotation is clockwise facing the shaft end, with counter-clockwise rotation available if required. For best QH pump operation, Gerotor recommends hydraulic oils with viscosity between 250 and 330 ssu at 100° F.

Slitting Machine Spaces

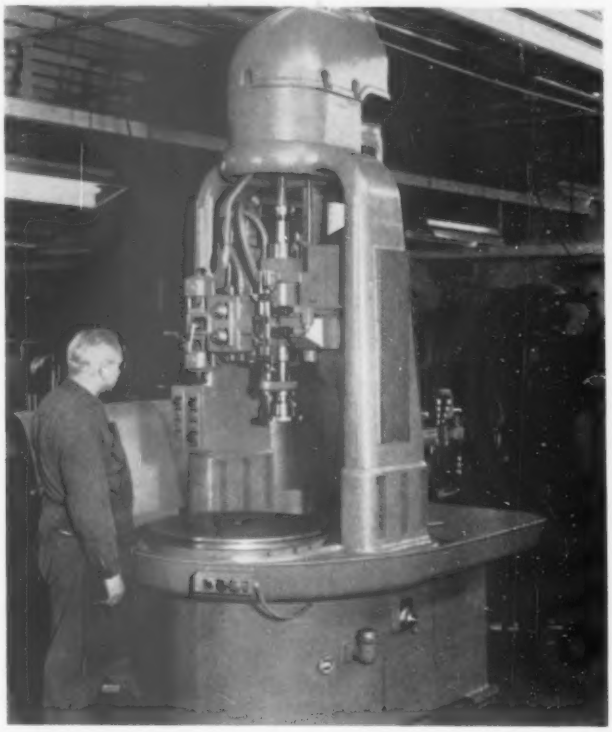
Industrial Products Suppliers, 108 Water St., New York 5, N. Y., announce an unusual service to users of slitting machines. Developers of the Artus ("The Color Tells the Thickness") Plastic Arbor Spacers and Shim Stock, Industrial is now ready with a complete range of sizes for use on slitting machines. The new Artus **SLITTING MACHINE**



SPACERS are available in any size up to 20" diameter. In addition to the ease with which they are identified by color, they boast another advantage—namely, unusual low cost even in small quantities. This is due to the low cost of dies for plastics spacers as compared to the several hundred per cent higher cost of dies for metal spacers. Descriptive literature is available from the makers.

Drill-O-Matic by Edlund

A NEW MACHINE—the **DRILL-O-MATIC**—by *Edlund Machinery Co., Inc.*, Cortland, N. Y., is designed for high production, low cost indexing operations with single tools or multiple spindles, automatic or semi-automatic operation. Readily apparent is its unusually clean design and rugged construction, indicative of advanced tool engineering.



The machine is extremely versatile, and will automatically perform intricate, precision drilling, countersinking, counterboring, spot facing, reaming and tapping operations over a wide range of workpieces at a minimum of tooling cost. Flexibility of operation is obtained by an almost infinite number of combinations of spindle and indexing operations, all obtained through simple adjustments and table substitutions. Among other features, the right leg of the frame is machined for mounting of an independently driven tapping head, or other tool; also, the machine is readily adaptable to angular drilling.

The operating cycles are controlled throughout by Vickers hydraulic equipment. Correct timing, between spindle and indexing table, is assured by a dual safeguard. When used for automatic operation, a selector switch is set for "repeat," and the spindle will feed and return, with the table automatically indexing. This is followed by complete automatic cycle, and the function continues until stopped by the operator. When set for "semi-automatic," the spindle will complete its cycle, the table will index, but the spindle will not repeat until the button is pressed to start the repeat cycle.

New Soluble Oil

A NEW **CUTTING FLUID**—Gulf Soluble Oil—announced by the *Gulf Oil Corporation*, Pittsburgh, Pa., is claimed to be the only soluble cutting oil which combines, together with all-water miscibility, high lubricating value and non-foaming and rust preventative characteristics, along with a pleasant odor.

Further information on the new oil, which is said to improve finish, increase tool life and, therefore, production, may be had from the company along with recommendations for proper dilution for specific machining operations.

North East West South in Industry

PARK SANDERSON has been appointed Manager of the Boston plant, **Joseph T. Ryerson & Son, Inc.,** steel distributors, succeeding Herbert C. Wills, who has retired. Mr. Sanderson has been active for the past 20 years in Ryerson service and management operations, particularly in the New England area.

ROY FARQUHARSON, who was recently promoted to Ass't Chief Eng'r, **Pioneer Eng'g & Mfg Co.,** Detroit, is a Charter Member, A.S.T.E., and a veteran of more than 20 years experience in designing tools, dies and fixtures. Mr. Farquharson has been associated with the Pioneer organization for 11 years; and, during the war, he supervised tooling programs for some of the nation's leading industries.

FREDERICK U. CONARD, formerly vice-president of Underwood Corp'n, has been appointed President and Gen'l Mg'r of **Niles-Bement-Pond Co.,** West Hartford, Conn., replacing Charles W. Deeds, resigned, according to announcement by Clayton R. Burt, Board Chairman. Mr. Deeds will continue as a Director of the company.

Gisholt Machine Co., Madison, Wis., has opened new sales offices in Los Angeles at 724 S. Spring St., and also in San Francisco at 420 Market Street.

Newest branch office of **ISLAND EQUIPMENT CORP'N** of New York City is located in Detroit at 2631 Woodward Ave., with **Denny Bohn,** Conveying and Materials Handling Eng'r, in charge.

SHEFFIELD CORP'N, Dayton, Ohio, announces formation of an Australian company for the production and sale of gages, instruments and machine tools, as well as contract eng'r and mfg services—to be known as **Sheffield Corp'n of Australia Pty. Ltd.** This is in line with the long-range expansion plans of Sheffield, but was made necessary now due to high import duties placed on manufactured goods by the Australian government.

EDWARD A. LEDEEN, formerly Chief Eng'r, Gotham Eng'r Co., has been named Gen'l Mg'r of **Production Methods, Inc.,** New York City. Mr. Ledeen was at one time Chief Tool Engineer for Brewster Aeronautical Corp'n, and Project Tool Engineer on the B-17 and TBY-2 programs during the war.

O'Neil-Irwin Mfg Co., builders of Die-Less Duplicating Equipment, have moved their general offices and all manufacturing facilities to Lake City, Minnesota, which is about 70 miles from Minneapolis, former location of the company.

HAROLD F. BOWER, formerly in charge of the Truarc Technical Service Staff, has been named Sales Mg'r, **Truarc Retaining Rings Div'n,** *Waldes Kohinoor, Inc.,* Long Island City, N. Y. Mr. Bower, a graduate of Cornell University in '22, will have charge of enlarging technical facilities as well as sales for Truarc.

Anton Erhardt, Sr. (right) formerly factory superintendent, and just recently named Chief Engineer, **NATIONAL TOOL COMPANY,** Cleveland, first began work with National, 40 years ago, as a machine-hand. His vacated position goes to **James C. Grossman,** formerly production mg'r of The Cleveland Automatic Machine Company, according to announcement by Harry W. Barkley, President and Gen'l Manager of National.

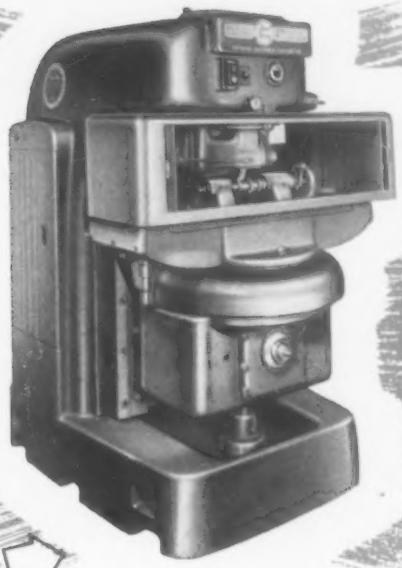
Nat'l Twist Drill & Tool Company announces removal of all manufacturing facilities, formerly in Detroit, to their new Rochester, Michigan, plant. Stockroom and offices, however, will still be maintained in Detroit at E. Grand Blvd. and Brush St.; but customers outside Detroit are asked to communicate directly with the company's new main office in Rochester.

W. F. BOYLE, formerly gen'l mg'r of **Pelton Water Wheel Co.,** a subsidiary of The Baldwin Locomotive Wks, has been named Vice-President of that company according to announcement by Ralph Kelly, President of Baldwin. Mr. Boyle, previously with Westinghouse since '27, joined Baldwin in May of 1945.

At the annual meeting of the **DETROIT AREA ASSOCIATED MACHINE TOOL DISTRIBUTORS,** the following officers were elected: **C. R. Austerberry,** President; **Ray H. Farmer,** Vice-President; **John Sauer, Jr.,** Sec'y-Treas.; and **Harry C. Hoover,** Ass't Sec'y-Treasurer.

MONARCH MACHINE TOOL CO., Sidney, Ohio, announces transfer of its Eastern Sales Office from Newark, N. J., to New York City, 8113 Empire State Bldg., with **N. H. Critton** in charge. Additionally, **Rex Wilson,** formerly of the Detroit office, will go to the Pittsburgh office; and **N. L. Dilworth,** from the home office, will become a field sales eng'r with headquarters in Toledo, Ohio.

Metallurgical Service Laboratory, shown in photo, has just been completed by **Ajax Electric Co., Inc.,** Philadelphia manufacturer of Ajax-Hultgren Electric Salt Bath Furnaces. Although no commercial heat treating work will be performed here, production executives or metallurgists who wish to compare physical characteristics of salt bath heat treating with other methods, can now submit specimen work to this laboratory which will be treated without charge or obligation.



A DIAGONAL GEAR SHAVING MACHINE FOR HIGH PRODUCTION

The new Red Ring Model GCU Diagonal Shaving Machine has been developed especially for mass production. While the principle of Rotary Crossed Axes shaving which has proved itself over the years is retained, an entirely new method of its application provides a number of advantages in production operations. Some of these are:

1. Greater stock removal on each cutting stroke.
2. Reduced time for each cutting cycle.
3. Complete cutting cycle just two passes under cutter.
4. Cutter life materially extended.
5. Cutter cost greatly reduced in many cases.
6. No special cutters required.
7. Better control of lead angle on helicals.
8. Operator fatigue reduced.
9. Oversize gears automatically screened out.
10. Operator's haste cannot jeopardize tooth surfaces.
11. Amount of crown on Elliptiod teeth can be varied.

For full details write for bulletin.

2523

RED RING PRODUCTS

NATIONAL BROACH AND MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE • ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

Welded Steel Cuts Cost 27%

By C. D. Bonifield
Vice-President in Charge of Production
The Globe Company, Chicago, Ill.

IN our development program of continually improving the designs and production of our machinery for the meat packing industry, we have found it helpful to think in terms of arc welded steel construction. This affords a highly flexible approach to our problems and the end result is beneficial to the users of our products, the welded designs being strong, rigid, light-weight and of smooth, sanitary surfaces.

Fig. 1. Dry rendering cooker of welded construction.

One design which has been changed recently to welded steel construction is the saddle for the dry rendering cooker shown in Fig. 1. Two of these saddles support the welded pressure vessel on the welded base of this machine.

Fig. 2. Saddle support member of former design.

Fig. 3. Welded steel saddle costs 27% less than former design.

Fig. 4. Fixture used for assembly of welded saddle.

A saddle of former construction is shown in Fig. 2. The welded steel saddle, shown in Fig. 3, is produced at a total saving of 27% in cost over the former design.

The welded saddle, 60″ wide, 24″ high and 8″ deep, is fabricated from ½″ mild steel plate, consisting of four pieces, flame-cut and brake formed. The parts are assembled in the welded fixture shown in Fig. 4, which is placed on a work table in the flat position. After tack welding the parts together, the assembly is removed from the fixture and finish welded as shown in Fig. 5, with the saddle positioned for downhand welding of all joints. This requires continuous, two-pass fillets on both sides to join the flange to the web. The end pieces of the flange are butt-welded on both sides to the top flange assembly.

Fig. 5. Joints are positioned for downhand welding.

In approaching designing problems, our engineers have been aided by the Studies in Machine Design published by Lincoln Electric. These can be secured by writing to THE LINCOLN ELECTRIC COMPANY, Dept 412, Cleveland 1, Ohio.

GEAR HIGHLIGHTS

VOL. XI NO. 2

This is page 1 of the current issue. Write for the complete issue today.

ALSO IN THIS ISSUE

How to Get Extra Tool Life Free ..... p. 4
New Literature Available.. p. 4
New Minnesota Representative ..... p. 4

STANDARDIZED CONE-DRIVE SPEED REDUCERS NOW AVAILABLE

A complete standardized line of speed reducers, built around double enveloping Cone-Drive gearing is now in quantity production at the Cone-Drive plant of Michigan Tool Company in models to suit practically every requirement. The horsepower and torque these units will transmit for a given size is quite startling to anyone not familiar with Cone-Drive gearing.

The new standardized line includes models with pinion under, pinion over, and with gear shaft vertical. The center distances of from 2 to 18 inches cover a power-transmission range equivalent to 3″ to 24″ center distance in worm

(Continued on page 3)

UNDERPASS CURVE-SHAVING *Features* WISCONSIN AXLE'S PRODUCTION OF LARGE GEARS TO HIGH PRECISION

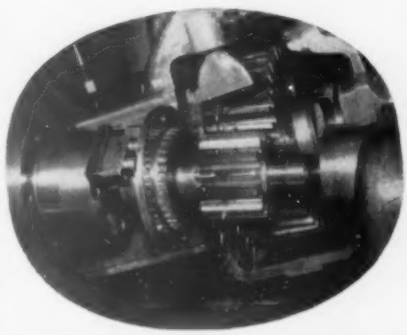
by PERRY L. ADAMS, Gear Superintendent
Wisconsin Axle Division—Timken-Detroit Axle Co.

Since the introduction of shaving into the gear manufacturing cycle, including the curve-shaving of pinions—and particularly since the Underpass method of shaving has been adopted, Wisconsin Axle Division of Timken-Detroit Axle Company, Oshkosh, Wisconsin, has not only been able to reduce manufacturing time and costs but has also been able to improve gear quality. Among the benefits reported are:

1. Less variation in involute form
2. More accurate tooth spacing
3. Correction of lead errors
4. More desirable mating contact between gears
5. Production output increase

These improvements result in corresponding improvements in the service life and quietness of the heavy duty gears which Wis-

(Continued on page 2)



MICHIGAN "SINE-LINE" LEAD — COMPARATORS —

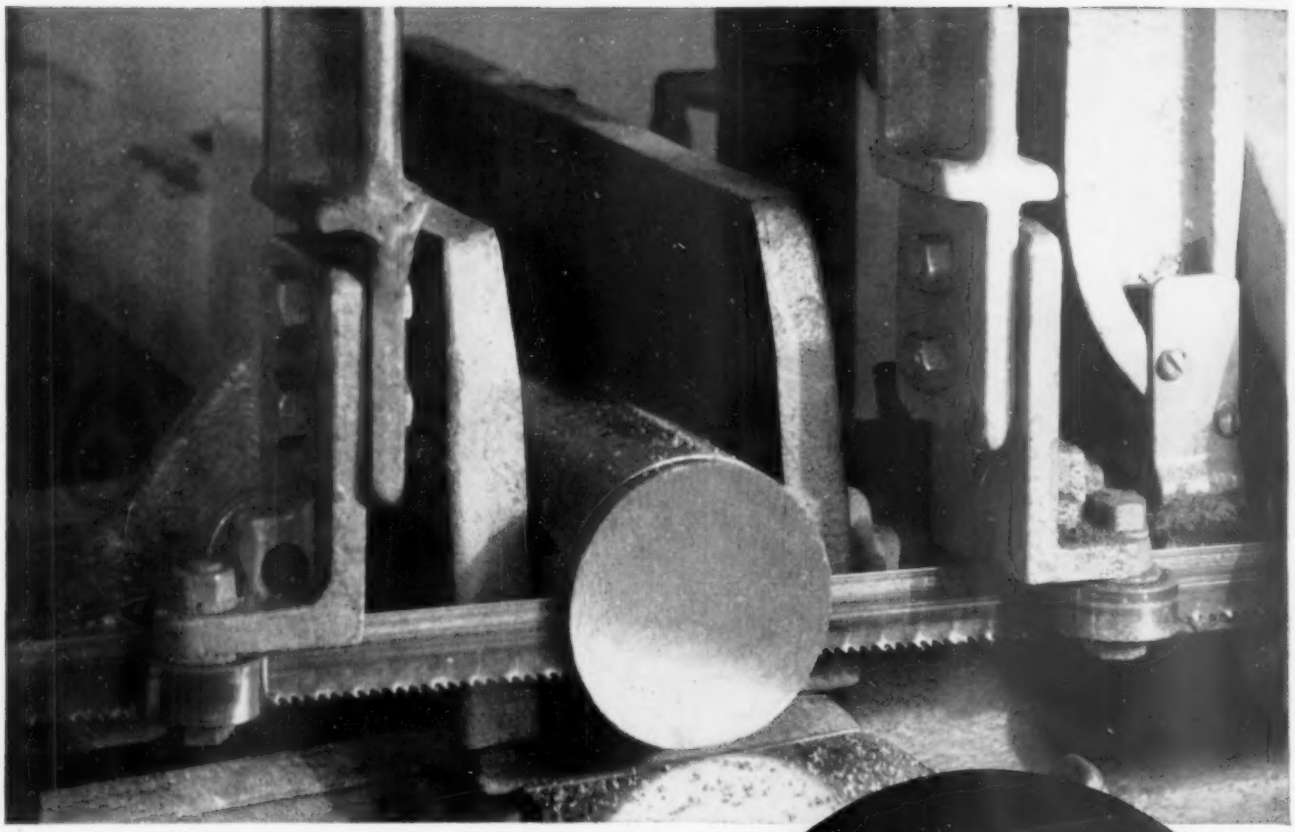
Known as models 1200 and 1200A, virtually foolproof Michigan lead comparators are available for use on the production floor alongside gear cutting and shaving machines. The master multiple thread lead, followers, indicators and actuating mechanisms are all enclosed.

Machines may be used as an aid in setting up gear cutting and finishing machines, to check gears after processing, to determine lead compensation for "unwinding" of gears during heat-treat, etc.

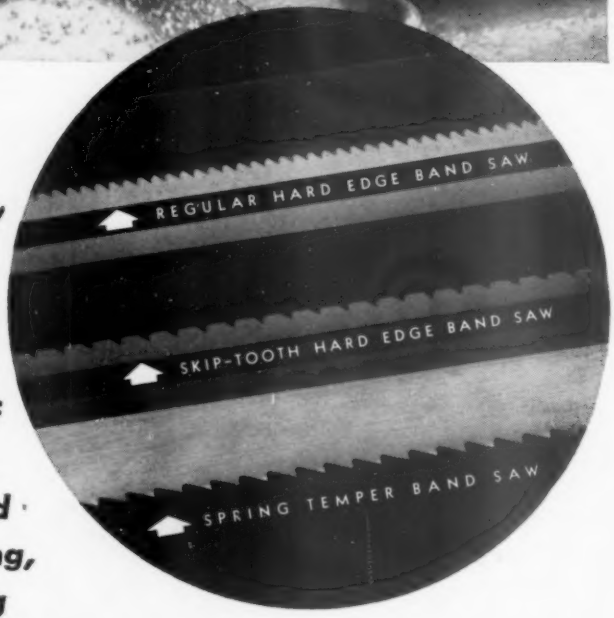
They are applicable to both external and internal gears as well as worms. To change the machine over for checking gears of differ-

(Continued on page 4)

MICHIGAN TOOL COMPANY 7171 East McNichols Road DETROIT 12, - - U.S.A.



Climb on the SIMONDS "BAND-SAW WAGON"



Save Thousands of Hours by Band-Saw Cutting . . . instead of Shaping, Milling, Turning, Drilling

Getting to be a "Big Parade" . . . the way shops are swinging to metal band-sawing . . . and keeping their one-purpose machines free to do the work for which they were designed.

Simonds Metal-Cutting Band Saws can do a score of jobs, and do them all at top speed and accuracy . . . cut-off work, contour cutting, and cutting of irregular shapes like jigs, dies, fixtures, as well as heavy straight production cuts . . . and many other similar jobs.

And Simonds Metal Bands earn top profits on these jobs because they're made to *stay* on the job many hours longer . . . running smoothly, easily, cleanly. Simonds special steel, perfect tooth-milling and even tooth-set . . . those are the Simonds *extras* that *pay you extra* on every Simonds Metal Band you buy. Order from your distributor today.

SIMONDS
SAW AND STEEL CO.
FITCHBURG, MASS.
Other Divisions of SIMONDS SAW AND STEEL CO. making Quality Products for Industry

SIMONDS — Special Electric Furnace Steels
SIMONDS — Grinding Wheels and Grains
SIMONDS — Simonds Products for Canada

BRANCH OFFICES: 1350 Columbia Road, Boston 27, Mass.; 127 S. Green St., Chicago 7, Ill.; 416 W. Eighth St., Los Angeles 14, Calif.; 228 First St., San Francisco 5, Calif.; 311 S. W. First Ave., Portland 4, Ore.; 31 W. Trent Ave., Spokane 8, Washington. *Canadian Factory:* 595 St. Remi St., Montreal 30, Que.

SMASHING all previous Carbide records!

ANOTHER TYPICAL CASE

Part: Rotors—Electrical Motors
Machine: J & L Universal Turret Lathe
Operation: Turning O. D.
Material: Silicon Steel and die-cast Aluminum laminations
Diameter: 5″
Length: 3″
Depth of cut: .030″-.125″
Feed: .033″
Speed: 440 fpm.
PIECES PER GRIND: 350 (average)
Best previous carbide performance: 120 pieces

Improved

TECO Cemented Carbide

gives

- more pieces between grinds
- more grinds per tool
- less down time
- lower tool cost

DOZENS of plants are now getting from 3 to 10 times their former output per carbide tool, by using Improved TECO Cemented Carbide. If such phenomenal production reports seem "too good to be true" . . . it's only because you have not tried Improved TECO Cemented Carbide.

Find out for yourself! Tool up any regular carbide job with Improved TECO Cemented Carbide. Run under identical conditions. Then check your pieces per grind —grinds per tool—tool life—tool cost. Check, too, its unusual ability to operate at higher speeds and feeds.

A TECO engineer will gladly demonstrate in your plant. If you prefer making your own run, send details of your job set-up for recommendation. Latest catalog and price list sent upon request.

Improved

TECO

CEMENTED CARBIDE

TUNGSTEN ELECTRIC CORPORATION
570 39th STREET, UNION CITY, N. J.
Branch Office: 403 Western Reserve Bldg., Cleveland 13, Ohio
Representatives: Indianapolis, Ind., Detroit, Mich.

4 times

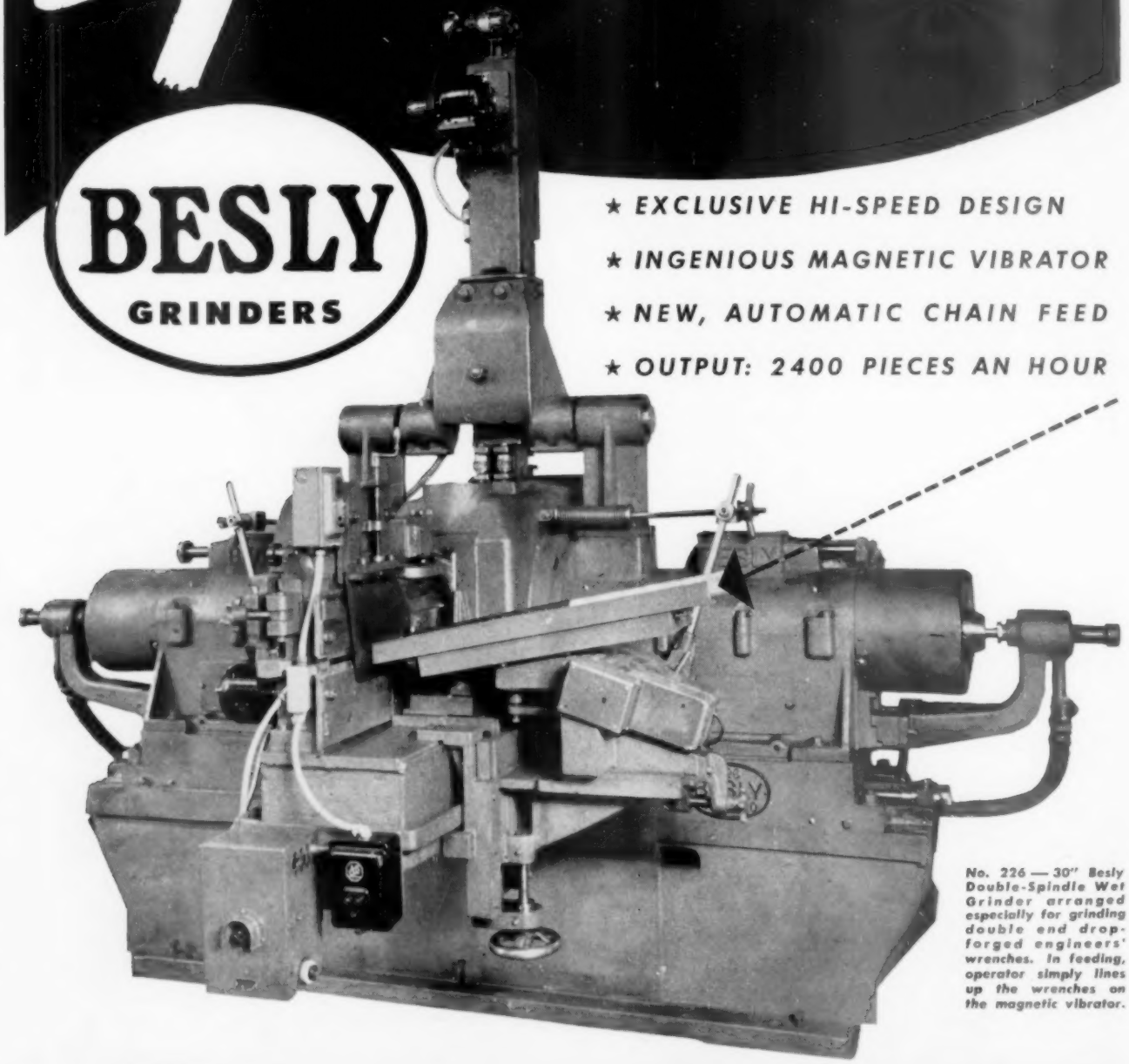
BESLY
GRINDERS

★ *EXCLUSIVE HI-SPEED DESIGN*

★ *INGENIOUS MAGNETIC VIBRATOR*

★ *NEW, AUTOMATIC CHAIN FEED*

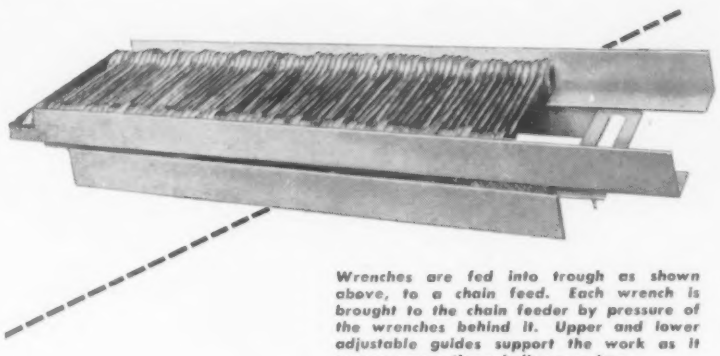
★ *OUTPUT: 2400 PIECES AN HOUR*



No. 226 — 30" Besly Double-Spindle Wet Grinder arranged especially for grinding double end drop-forged engineers' wrenches. In feeding, operator simply lines up the wrenches on the magnetic vibrator.

BESLY BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

faster...

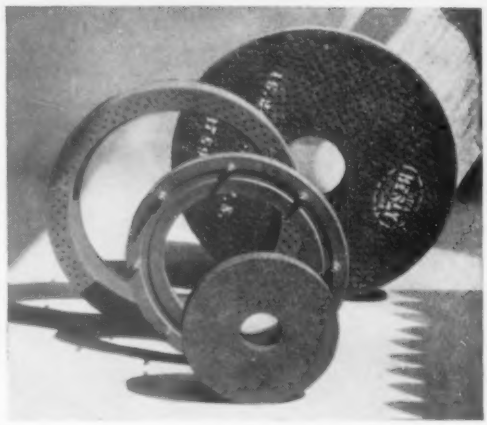


Wrenches are fed into trough as shown above, to a chain feed. Each wrench is brought to the chain feeder by pressure of the wrenches behind it. Upper and lower adjustable guides support the work as it passes across the grinding members.

Production figures show 300% increase in the output of 8-inch drop-forged wrenches, and similar pieces, ground on this new-type Besly Double-Spindle Wet Grinder. With oil as a coolant, this high-speed unit turns out 2400 pieces an hour—*quality improved,* all four surfaces accurately ground . . . and *the ends free from taper.*

Magnetic vibrator and automatic chain feed do away with hand feeding. Only one pass through the grinder is necessary. Finished pieces emerge flat, parallel and ready for final polishing. Production costs are sharply reduced by the elimination of old style, slow hand methods that required each end of the wrench to be ground separately.

These and other Besly Grinders are easily adapted to a wide variety of specialized jobs. With a background of more than fifty years accumulated experience Besly engineers are qualified and ready to help you combat rising production costs through the selection of an advanced-type grinder that will do your work with similar speed and precision.



For Accuracy, Convenience and Economy, You Can Depend On

BESLY-TITAN
Abrasive Wheels

Made of resinoid bond only, Besly-Titan Wheels assure smoother, better, finish—often without resorting to finer grit.

The semi-elastic nature of Resinoid bond permits operations at higher speeds with perfect safety.

Flexible Resinoid bond holds the grains just long enough which, in turn, increases wheel life.

Besly Steelbacs can be worn right down to the steel backing or nuts . . . NO ABRASIVE IS WASTED.

Abrasive grains can be blended in endless combinations FOR EVERY NEED when bonded with Resinoid.

Write for free copy of new ***ABRASIVE CATALOG*** *. . . now on the press. It's new, up-to-date and full of helpful information—illustrated by photos and diagrams.*

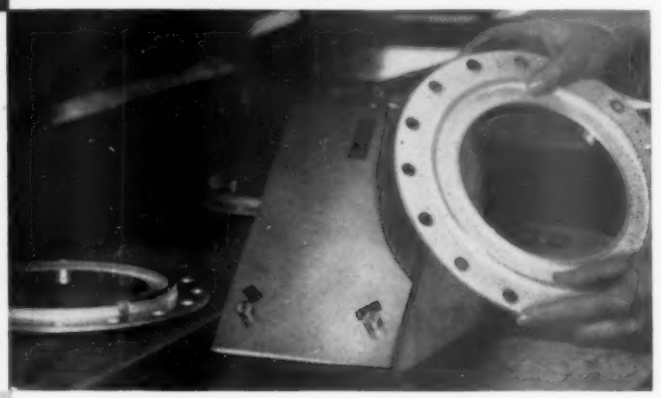
BESLY **CHAS. H. BESLY & COMPANY**

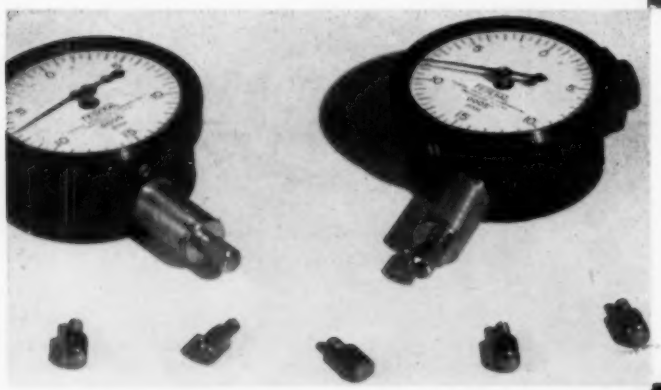
118-124 N. Clinton Street, Chicago 6, Illinois • Factory: Beloit, Wisconsin

If there is a Wear Surface on a Gage...
Wear-resistant **NORBIDE** *parts save Time and Money*

NORBIDE Gages are made of Norton Boron Carbide — the hardest material commercially produced—and it is this hardness which gives them their wear resistance. A NORBIDE plug gage measuring aircraft engine parts lasted 17 months where tungsten carbide lasted 14 days, chrome plated gage eight hours, tool steel gage four hours.

A new application of NORBIDE pieces is shown at the right where three rectangular NORBIDE inserts were used on an angle face plate. On last report this gage had been in service for six months of checking for truth or run out as well as diameters of aircraft engine flanges. The hardened steel plate formerly used required resurfacing every 24 hours.

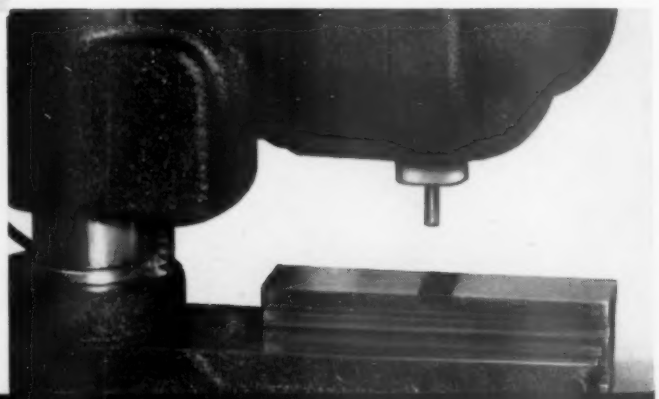




Contact points for dial indicator gages is a common use for NORBIDE shapes. NORBIDE gages will not pick up lint nor become charged with particles of metal. They are inert to chemicals ordinarily employed where gages are used. Because NORBIDE pieces weigh even less than aluminum, NORBIDE gages that are held in the hand cause much less fatigue.

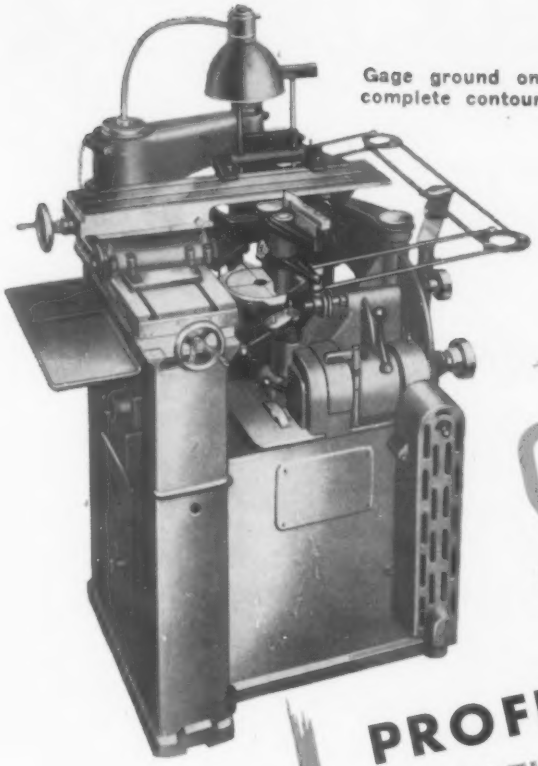
NORBIDE inserts are successfully used in the anvils of many gages. Because of their great wear resistance these anvils do not have to be constantly resurfaced, wear tolerances are eliminated and rejects are cut to a minimum. Ask your regular supplier about NORBIDE Gages or write to:

NORTON COMPANY, Worcester 6, Mass.

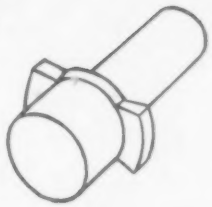


NORBIDE – The Hardest Material Made by Man

T. M. REG. U.S. PAT. OFF.



Gage ground on complete contour



Various radius gages ground from same template

STUDER

PROFILE GRINDER

VERSATILITY!

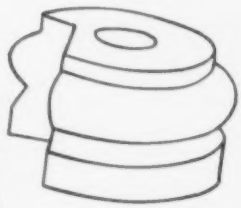
Grind straight or round form tools, sectional dies, gages of all kinds, templates, small dies and precision parts with the Studer Profile Grinder Type PSM. Profiles up to 6″ in length, circular work up to 4″ in diameter, parts up to 2″ in thickness can be handled. A special template holder permits the grinding of circular contours such as cams over their entire circumference.

SPEED!

One set up is all that is necessary for grinding any shape in one continuous operation, without removing work piece or template. Several flat pieces may be stacked up to 2″ in height for simultaneous grinding. Small profiles can be accurately produced without preliminary grinding to form, and clearances on parts such as form tools can be ground without changing the original setting.

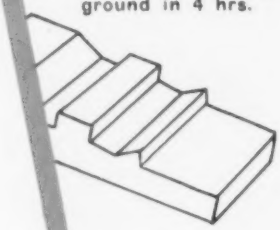
ACCURACY!

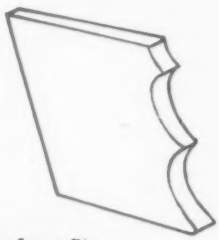
The Studer principle employs a tracer finger which follows the form of a template and transmits its movements to the grinding wheel through a pantograph. Because the wheel is shaped proportionately to the exact shape of the tracer finger, parts are ground complete in one operation—with one wheel. Fixed template eliminates errors due to incorrect manipulation. These features insure accuracy to within ±0.0002″. Our engineers will give you expert assistance in specific applications.



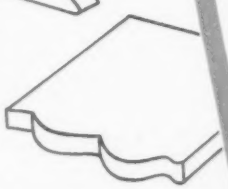
Circular form tool produced in 2½ hrs.

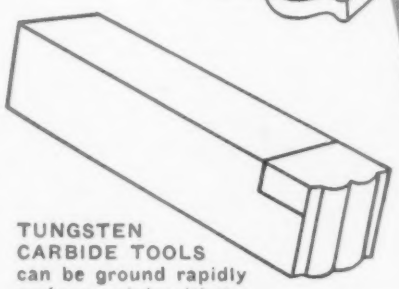
Profile gage 2.4″ long ground in 4 hrs.





Set of profile gages produced in 3 hrs.





TUNGSTEN CARBIDE TOOLS can be ground rapidly and accurately with the Studer Profile Grinder. A special diamond wheel dressing device, equipped with a Carborundum cup wheel, assures accurate forming of bakelite and metal bonded wheels.

Form tool ground on complete contour.

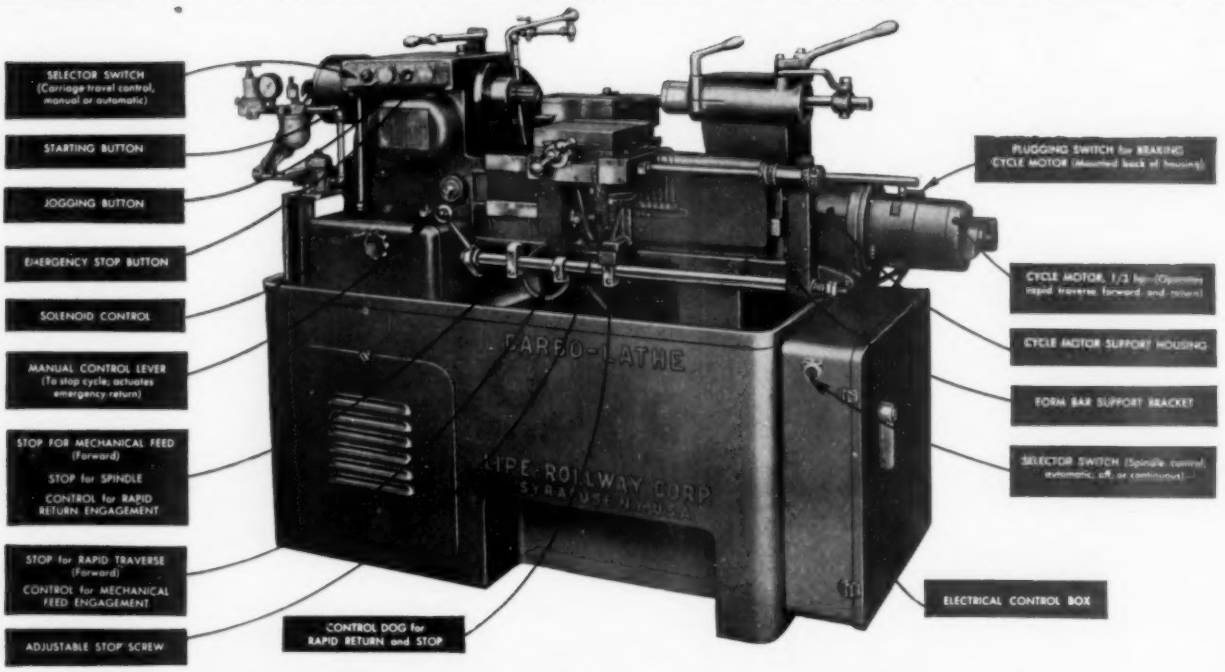
COSA CORPORATION

COSA

CHRYSLER BUILDING
New York 17, New York

COMPLETE CYCLE ELECTRICALLY CONTROLLED

STEPS-UP PRODUCTION! **REDUCES FATIGUE!**


SELECTOR SWITCH (Carriage travel control, manual or automatic)
STARTING BUTTON
JOGGING BUTTON
EMERGENCY STOP BUTTON
SOLENOID CONTROL
MANUAL CONTROL LEVER (To stop cycle; actuates emergency return)
STOP FOR MECHANICAL FEED (Forward)
STOP for SPINDLE
CONTROL for RAPID RETURN ENGAGEMENT
STOP for RAPID TRAVERSE (Forward)
CONTROL for MECHANICAL FEED ENGAGEMENT
ADJUSTABLE STOP SCREW
CONTROL DOG for RAPID RETURN and STOP
PLUGGING SWITCH for BRAKING CYCLE MOTOR (Mounted back of housing)
CYCLE MOTOR, 1/3 hp—(Operates rapid traverse forward and return)
CYCLE MOTOR SUPPORT HOUSING
FORM BAR SUPPORT BRACKET
SELECTOR SWITCH (Spindle control, automatic, off, or continuous)
ELECTRICAL CONTROL BOX
CARBO-LATHE
LIPE-ROLLWAY CORP
SYRACUSE N.Y.U.S.A.

LIPE *Carbo-Lathes*

For fast, simple operation, just push the starting button . . . Instantly the spindle starts, the carriage moves rapidly up to the cutting position, and the mechanical feed engages automatically.

At the end of the feed cut, the mechanical feed disengages and the carriage stops for predetermined length of time to allow tools to clear themselves. At the precise moment, the spindle stops and the carriage returns quickly to the loading position, all ready for the next operation.

GET MORE PRODUCTION FROM YOUR PRESENT LIPE CARBO-LATHES

LIPE Automatic Complete Cycle Attachment may be used on any LIPE Carbo-Lathe bearing a serial number of 200 or more, and may be used on either plain or taper turning type front carriage.

See Your LIPE Distributor for Full Money-Making Details

Your operator always has control. With the manual control, he can disengage and re-engage feed . . . stop spindle . . . return carriage at any point in the operation.

The selector switch permits continuous operation of the spindle. The push button or remote limit switch starts feed at the beginning of cycle. Complete change of set-up can be made in just a few seconds by moving only three adjustable stops.

NOTE: Lipe Carbo-Lathes are sold with or without Complete Cycle Attachment.

LIPE ROLLWAY

***Lipe*-ROLLWAY CORPORATION • SYRACUSE 1, N. Y., U.S.A.**

Cable Address: LIPEGEAR

IF YOU ARE INTERESTED IN *Efficient* BROACHING PRODUCTION

Here is the complete broach service that guarantees you'll get it!

PLANNING

Detroit Broach aids in selecting your machines or adapting them . . . supplies complete cost and production data.

ENGINEERING

Tooling is designed by men who specialize in broach tooling only . . . men who know broaching technique.

MANUFACTURING

Tooling is produced on equipment selected specifically for the manufacture of broach tooling . . . in a plant producing nothing else.

SET-UP & TRY-OUT

Your machine set up and tried out at Detroit Branch . . . delivered to you *ready to go.*

FOLLOW-THRU

If difficulties later occur, field engineers are on the spot with the answer.

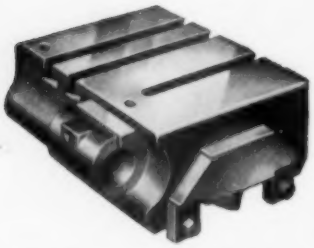
and it's handy, too.

Wherever you are, there is a Detroit Broach representative in your locality to give you prompt service.

MEMBER BROACHING TOOL INSTITUTE

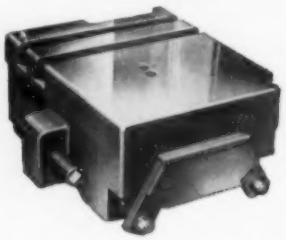
DETROIT *Broach* COMPANY

20201 SHERWOOD AVENUE • DETROIT 12, MICHIGAN

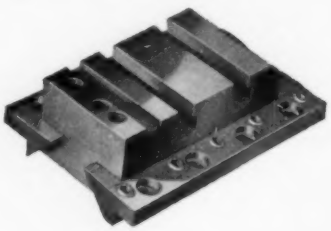


ALL SIZE MULTIPLE SPINDLE
F OR G GRIDLEY

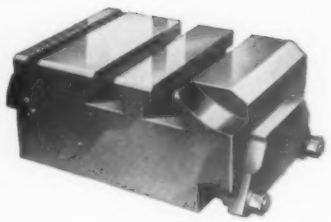
TAKES CUTS AT SPEEDS *Never Thought Possible!*



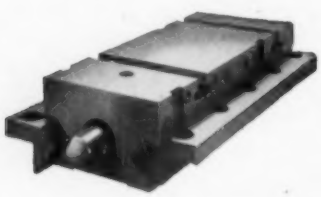
ALL SIZE SINGLE SPINDLE
GRIDLEY



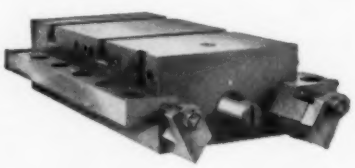
CUT-OFF SLIDE FOR 9/16",
3/4", OR 7/8" F OR G GRIDLEY



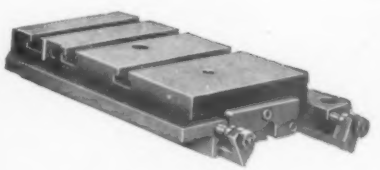
CUT-OFF SLIDE FOR 1-1/4" TO
2-5/8" F OR G GRIDLEY



1ST AND 5TH POSITION 9/16"
C ACME



1ST AND 5TH POSITION 1"
AND 1-5/8" C ACME



1ST AND 6TH POSITION R, R-A,
R-A-S ACME-GRIDLEY; ALSO 4-H
AND G-A GRIDLEY

Due to heavier construction, Slitters Slides are guaranteed to form or cut off any work which is within the machine's capacity. Their three and one-half times greater bearing surface, combined with their heavier construction, eliminates all rocking and swaying regardless of the amount of the cut taken. This feature makes Slitters Slides particularly important for close tolerance work; or large jobs can be done faster, with fewer operations, and longer tool life.

Adjusting gibs and moving parts of all slides for F or G Gridleys and Single Spindle Gridley, except the 9/16, 3/4 and 7/8" cut-off slide, are made of hardened and ground alloy steel working on scraped surfaces of nickel iron. The 9/16, 3/4 and 7/8" cut-off slide for F or G Gridleys, forming and cut-off slides for "C" Acme, "R", "R-A", "R-A-S" Acme-Gridley, also "4-H" and "G-A" Gridley are hardened throughout guaranteeing accuracy and longer tool life. Easily made adjustments will positively remain locked in position due to adjusting tapered gibs running the full length of the slide.

Try these slides. Convince yourself of the many features which make them the best slides you ever used.

SCREW MACHINE TOOL COMPANY

17565 Swift Avenue **Detroit 3, Mich.**

Monarch's Speedi-Matic gives you

up to 10 preselected speeds— automatically

● Automatic electronic speed change—repeated piece after piece without attention on the part of the operator!

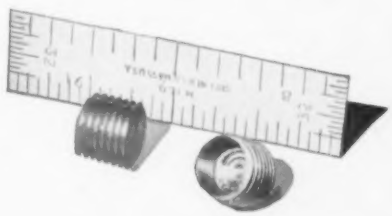
That's *one* of the reasons why the Monarch Speedi-Matic is winning the reputation of the "World's Fastest Hand Screw Machine"—and justifiably so: finished-parts production times are really *production* times, hardly more than the total of the actual times required for the separate cuts—each made *at the optimum surface cutting speed for that particular operation.* (And spindle speeds range up to 5,000 rpm!)

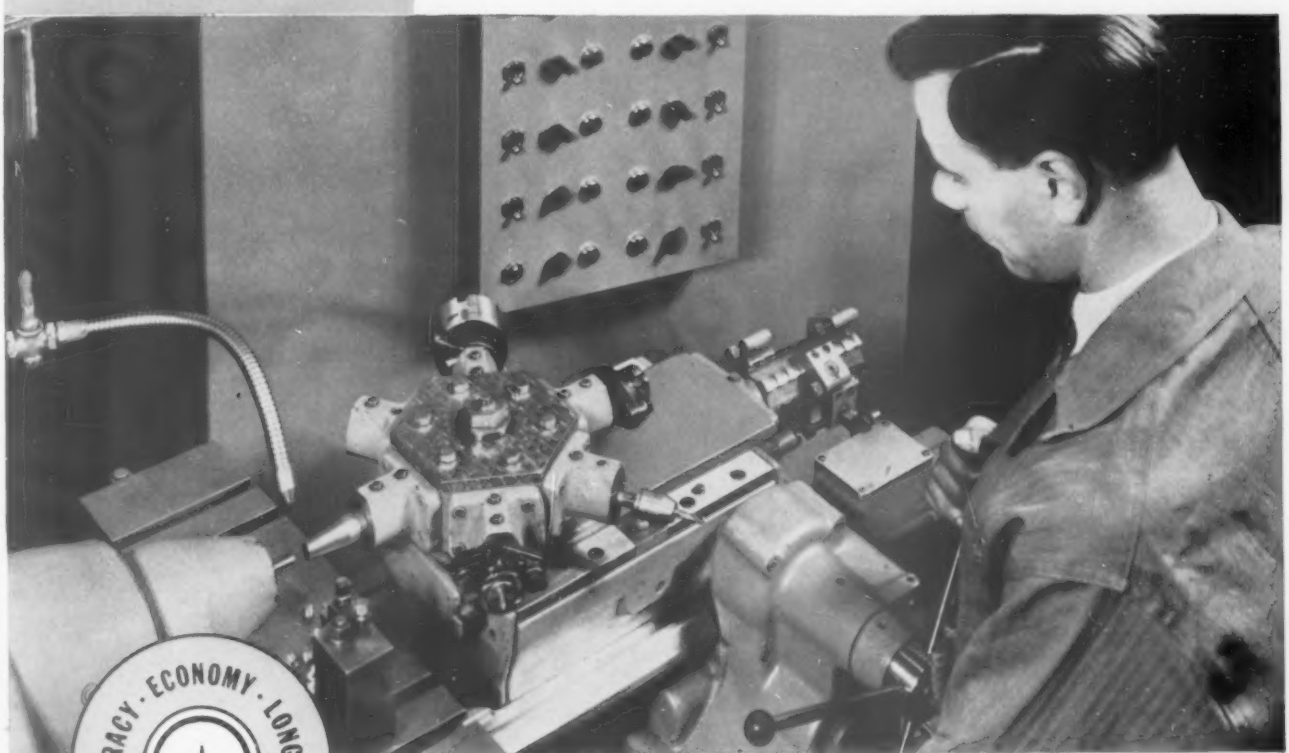
Take the part shown, for example—five different spindle speeds, from a low of 250 rpm to a high of 3,800 rpm—yet the *total* time, including five separate machining operations, is only .43 minutes. Match that record on your present machine, if you can—then send for complete information on the Speedi-Matic!

THE MONARCH MACHINE TOOL CO. • SIDNEY, OHIO

THE PART—spring cap, $\frac{3}{8}$" diam., $\frac{5}{16}$" long; x 1315 steel.

THE PRODUCTION FACTS—Center drill at 3,800 rpm; $\frac{9}{32}$" drill at 3,300 rpm; Flat bottom drill at 3,500 rpm; Thread at 250 rpm; Cutoff at 2,500 rpm. Total time—.43 minutes.

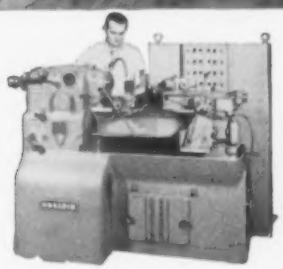




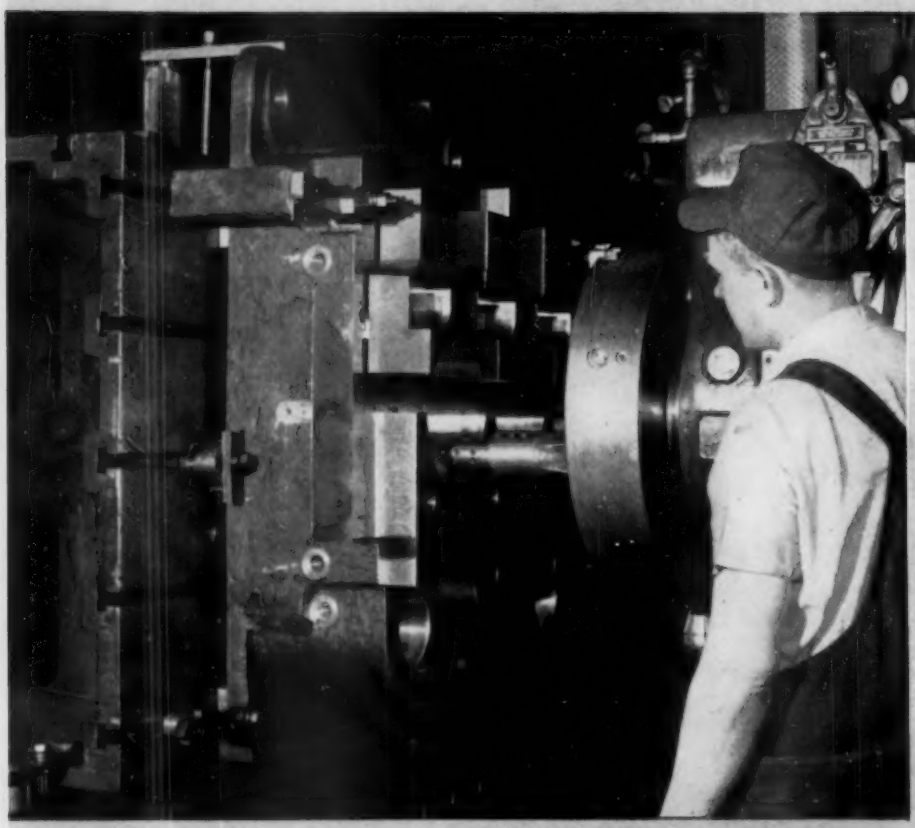
ACCURACY · ECONOMY · LONG LIFE

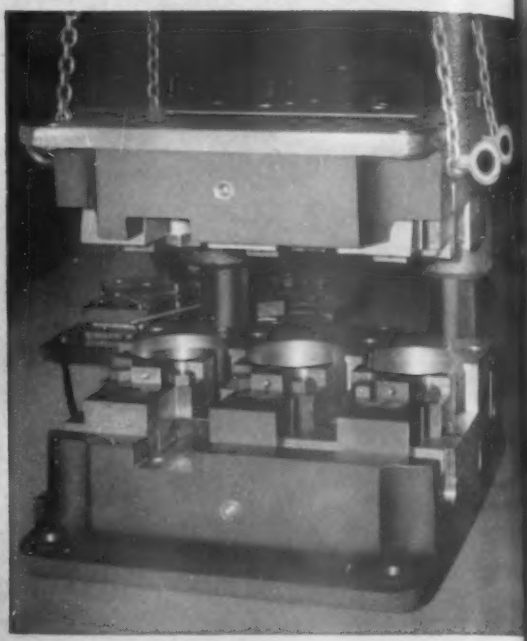
Monarch TURNING MACHINES

For "peak production at a profit"—on bar work up to $\frac{7}{8}$" diameter, in lots of 25 to 500 or more—write for our new 20-page catalog on the Monarch Speedi-Matic.



Now Danly Special Die Sets





with any additional machining required

New equipment installed in the Danly shop permits us to do any machine work on large or complex die sets incidental to the mounting of the dies. Inserts, recesses, additional boring, keyways and other machining can be done to the customer's specifications.

Time is saved by this service as work on dies and on the die set can be done at the same time. It permits the die shop or tool room to devote their equipment and man hours to the making of dies. The problem of the handling of big sets, for which the die shop or tool room are not generally equipped to do economically, is also solved by this service.

These special die sets are then delivered ready for the mounting of the dies. Note the size and complexity of the die set shown on this page. This die set—machined at Danly—is an example of the additional machining and service which this company offers.

On your next special die set inquiry include the additional machining work that you wish done at Danly while the die set is being made. The cost of this machining will be shown as a separate item in the quotation.

DANLY MACHINE SPECIALTIES, INC.

2100 South 52nd Avenue • *Chicago 50, Illinois*

Milwaukee 2....111 East Wisconsin
Detroit 16.....1549 Temple Avenue
Cleveland 14 . .1550 East 33rd Street
Dayton 2 .... 990 East Monument
Rochester 4...16 Commercial Street
Philadelphia 44 . .18 W. Chelten Ave.
Long Island City 1 47-28 37th Street
Ducommun Metals & Supply Company
4890 South Alameda, Los Angeles 54

DANLY *Special* DIE SETS

MACHINED TO YOUR SPECIFICATIONS

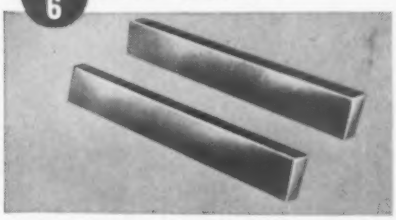
for high production at low cost

HAYNES STELLITE metal-cutting tools are made of specially developed alloys of cobalt, chromium, and tungsten. They are used efficiently and economically for machining most machinable materials—and for nearly all machining operations. These uniform, dependable tools operate at heavy feeds and high speeds—with long life between grinds. This means high production at low cost per piece machined.

You can order HAYNES STELLITE standard tools or special tools to your specifications through any Haynes Stellite Company Office. For more descriptive information, write for your copy of the new revised edition of "HAYNES STELLITE Metal-Cutting Tools," Form 5401.

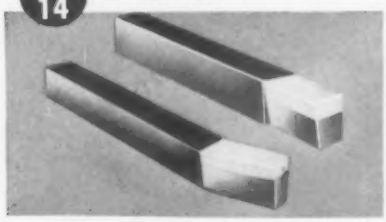
AVAILABLE STANDARD TYPES

PAGE 6 SOLID TOOL BITS



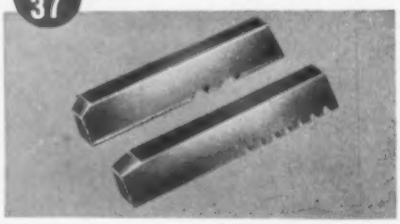
Square, flat, or round—in a wide range of sizes—finish-ground ready for use.

PAGE 14 TIPPED TOOLS



A large variety of styles and sizes—for use where solid bits are impractical.

PAGE 37 MILLING CUTTER BLADES



For many cutter body types—supplied finish-ground to close tolerances.

HAYNES *alloys*

TRADE-MARK

Haynes Stellite Company

Unit of Union Carbide and Carbon Corporation

UCC

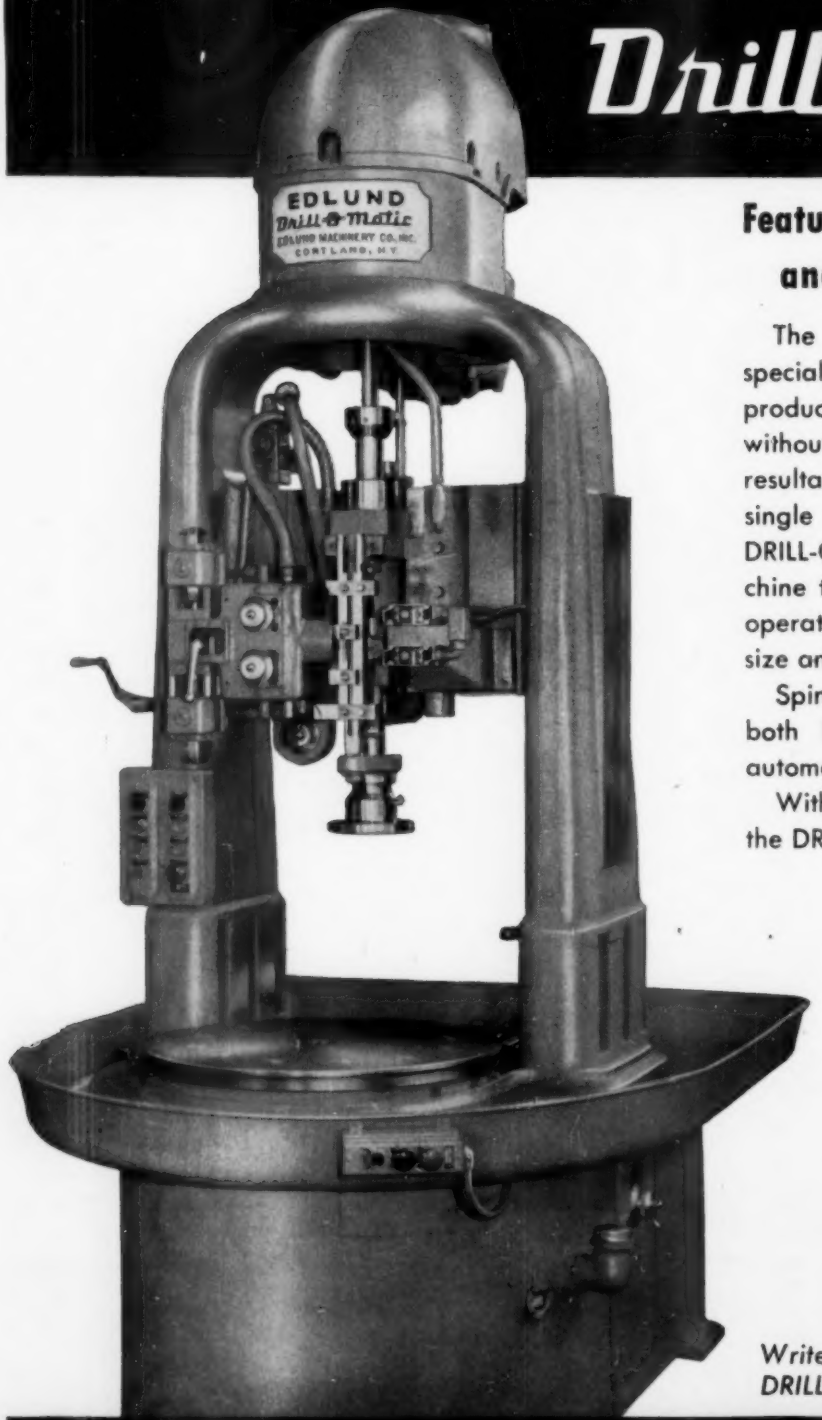
General Offices and Works, Kokomo, Indiana

Chicago—Cleveland—Detroit—Houston—Los Angeles
New York—San Francisco—Tulsa

The registered trade-marks "Haynes" and "Haynes Stellite" distinguish products of Haynes Stellite Company.

EDLUND

Drill-O-Matic



Features Maximum Production and Multiple Operations

The Edlund DRILL-O-MATIC gives special purpose utility and maximum production for drilling operations . . . without the danger of obsolescence and resultant high costs. In contrast with usual single purpose drilling equipment, the DRILL-O-MATIC is a highly versatile machine that is easily adapted to multiple operations on pieces of widely different size and shape.

Spindle cycles and table indexing are both hydraulic and can be set for automatic or semi-automatic operation.

With single tools or multiple spindles, the DRILL-O-MATIC—

- **Drills**
- **Reams**
- **Taps**
- **Counterbores**
- **Countersinks**
- **Spot Faces**
- **Flycuts**

Write for DRILL-O-MATIC Bulletin.

EDLUND MACHINERY CO. INC., CORTLAND 2, N. Y.

HOW TO UP PRODUCTION
MOUNTED
WHEELS — POINTS
The Bay State line contains "points" you cannot afford to overlook. They are made from solid blank forms and are shaped, trued, and sized on special lathes *after* mounting on steel mandrels. They are thus automatically pretested to make certain that the wheels and points are truly "stuck for life" to the mandrels.
Branch Offices and warehouses
Detroit — Chicago
Distributors — All principal cities
BAY STATE

Top Performance Consistently Duplicated

BAY STATE ABRASIVE PRODUCTS CO. • WESTBORO, MASSACHUSETTS, U.S.A.

REPORT Nº 1- ON TANTUNG *

REPORT No. 1	TOOL ENGINEERING REPORT	DATE: 1947

MATERIAL: Non-ferrous cast alloy. A homogeneous composition of Cobalt, Chromium, Tungsten, Carbon and Columbium/Tantalum carbides.

TRADE NAME: TANTUNG

GRADE: "G"

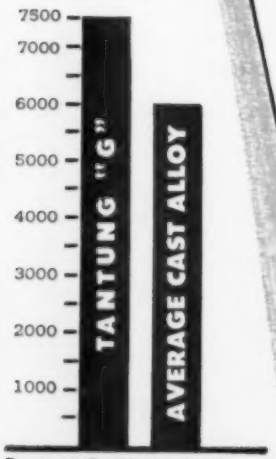
APPLICATION: For all machining and cutting operations. Cuts rolled, forged or cast steels—annealed or heat treated, cast irons, nonferrous and non-metallic materials.

PROPERTIES: *Density:* 8.8 gms per c.c. or 145 gms per cu. in.
Transverse Rupture Test: Average breaking load of ⅜" square specimen on 1½" centers is 7,500 lbs., equivalent to 320,000 psi.

CHARACTERISTICS: Performs at far greater speeds and feeds than high speed steels—produces 100% to 1,000% more pieces per grind. Easily ground, TANTUNG "G" is a tough, shock resistant cast alloy with an extremely low coefficient of friction. *Of particular interest is its high red hardness.*

DETAIL DATA: TANTUNG "G" is a general purpose cutting tool material adaptable to any machining operation using high speed steels and to many applications where carbides prove unsatisfactory. Easy to grind, TANTUNG "G" offers distinct advantages for smaller shops not having tool rooms for carbide grinding. Because of the higher rake angles possible, TANTUNG "G" is the ideal tool for present or old equipment without requiring increased horsepower. Its high transverse rupture strength permits its use as a solid tool, readily adaptable to the average tool holder. Easily brazed in a pocket or to a flat surface by standard brazing practice. Grain size and hardness are controlled by casting methods, imparting advantageous properties to TANTUNG "G" making it ideal for industrial applications such as shears, knife blades, wood working tools, etc. in addition to its superior performance in ferrous, non-ferrous and non-metallic cutting.

In eight years more than 3 million Tantung tools have performed successfully.



Transverse Breaking Load in lbs. on ⅜" Square Bar, 1½" Centers

Write today for your copy of TANTUNG Bulletin VR-227. Address request to Dept. TT347.

MAKERS OF WORLD'S FINEST VR Carbides

*Reg. U. S. Pat. Off.

VASCOLOY-RAMET CORPORATION NORTH CHICAGO ILLINOIS. U. S. A.
District Sales and Service in Principal Cities
AN AFFILIATE OF FANSTEEL METALLURGICAL CORPORATION AND VANADIUM ALLOYS STEEL COMPANY

DID YOU KNOW . . . that a large percentage of economy in carbide tool applications is wasted in converting standard tools to shop requirements. The practical solution to high tool conversion costs is V-R "CUSTOMER STANDARDS." Write or call your nearest Vascoloy-Ramet Field Engineer for full information on your "CUSTOMER STANDARD" tools.

SEND for your copy of the NEW VR-400 Carbide Tool and Blank Catalog. 32 pages of vital carbide engineering data. Address Dept. TE-247.

The amazing growth of cemented carbides in the past decade has opened the way to tremendous production increases. Vascoloy-Ramet, manufacturers of V-R Tantalum/Tungsten carbides is foremost in the development of carbides in industry. In keeping with this tradition of leading industry in carbide tool performance, V-R now takes another significant step forward by introducing V-R "CUSTOMER STANDARDS." Studies reveal that most users alter standard carbide tools before putting them to work ...an entirely unwarranted cost! BECAUSE TODAY . . . V-R "CUSTOMER STANDARD" tools, made to your design, can be used without ANY alterations, available in any grade and quantity at prices, less in fact, than it costs you to alter your present standard tools to shop specifications.

MAKERS OF WORLD'S FINEST VR Carbides

VASCOLOY-RAMET CORPORATION NORTH CHICAGO ILLINOIS, U. S. A.

District Sales and Service in Principal Cities

AN AFFILIATE OF FANSTEEL METALLURGICAL CORPORATION AND VANADIUM ALLOYS STEEL COMPANY

This Assembly Undergoes 19 FINISHING OPERATIONS at once!

STATIONS 1 and 2

STATION 3

Its mating parts fit together perfectly after one complete Bore-Matic cycle

HERE'S HOW a vacuum cleaner manufacturer achieves the balanced production of assembly units needed to speed his output and cut operating costs. He uses a single Heald No. 49 Double End Bore-Matic to finish mating parts at 3 separate stations, in *one* automatic cycle. Altogether, this machine performs 19 various finishing operations, including boring, plunge facing, chamfering and turning—each to extremely close tolerances.

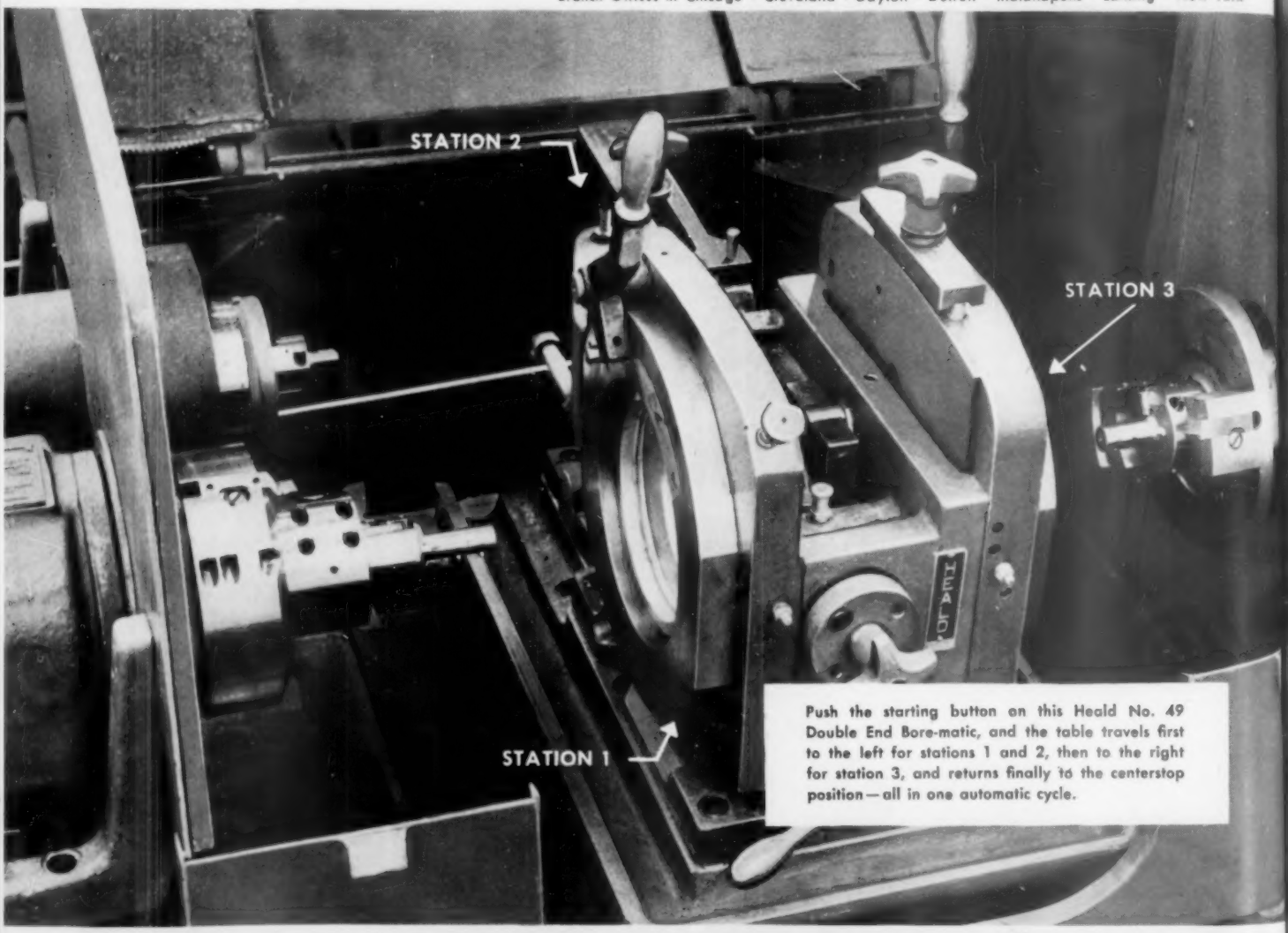
Intricate tooling setups like this one, worked out by experienced Heald engineers, can mean valuable indirect savings as well as greater production in your own work. For they produce uniformly accurate results which reduce scrap to a minimum, assure a fine finish, and speed final assembly. All finished parts match perfectly, providing a balanced output of parts and eliminating the need for costly hand fitting and selective assembly.

If you manufacture mating parts, or any other high precision product, let Heald engineers show you where the most accurate production methods are often the fastest and most economical. Get in touch with the Heald branch office nearest you, or write: THE HEALD MACHINE COMPANY, Worcester 6, Mass.

HEALD

means more precision . . . less cost

Branch Offices in Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • New York



Push the starting button on this Heald No. 49 Double End Bore-matic, and the table travels first to the left for stations 1 and 2, then to the right for station 3, and returns finally to the centerstop position—all in one automatic cycle.

INTERNAL AND SURFACE GRINDING MACHINES • BORE-MATIC PRECISION FINISHING MACHINES

HEAVY DUTY 3-JAW SELF-CENTERING CHUCKS

CUSHMAN

AMERICA'S FINEST

Designed and built to meet the requirements of heaviest duty service on turret and automatic lathes with carbide tools. The jaws, of hardened alloy steel, are deeply seated on wide body ribs. Jaws are tested to center within .003" total indicator reading. Bodies are of forged steel, heavily ribbed. Pinions and scrolls are extra heavy for use with long handle or power wrenches. Available for American Standard Type A-1 Spindles.

These chucks when fitted with soft blank top jaws and formed to hold work piece of special form provide adaptability to work requirements at minimum cost.

OTHER CUSHMAN STYLES & TYPES

4-Jaw Independent Chucks
Light, Medium and Heavy Duty

•

3 and 4-Jaw Self-Centering Chucks
Light, Medium and Heavy Duty

•

3 and 4-Jaw Combination Chucks
Medium and Heavy Duty

2-Jaw Chucks
Medium and Heavy Duty

•

Collet Chuck and Collets

•

Power Chucks, a complete line

•

Rotating and Stationary Air Cylinders
and Accessory Equipment

•

Power Wrenches

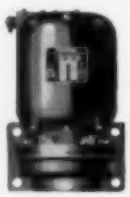
Write us for Catalogs and Literature

THE CUSHMAN CHUCK COMPANY
HARTFORD 2, CONNECTICUT, U. S. A.

PUMPS SUMPS DRY

The compact design of this Pioneer Coolant Pump, Model VBA, allows it to be installed in sumps, or pans, that are practically flush with the floor . . . designed to get the most out of a restricted or small sump base, it will empty the sump to the very bottom . . . efficiently handles coolants containing large chips or shavings . . . standard models available in capacities of 13-148 gallons per minute.

PIONEER MODEL VBA



...THE ONLY PUMP FOR SHALLOW SUMPS

400 MODELS

FOR LUBRICANTS AND COOLANTS

Pioneer Pumps in Seal-type, Seal-less and Rollway designs for pumping coolants, cutting fluids, abrasive liquids, lubricants and water available in every desired type and size. Please specify your needs when writing for information.

Pioneer Pump & Manufacturing Co.
19645 JOHN R ST. • DETROIT 3, MICHIGAN

SAWING FILING

GROB BROTHERS
GRAFTON WISCONSIN

THE NEW SAFETY "UTILITY"
MARKING OUTFIT

Holder Holds Nine Sizes of Type From 1/32" to 1/4"

Designed for light stamping work, the "Utility" outfit is ideal for marking etched plates, tags, keys, stock checks; brand names or stock numbers on steel bars; special coding, serial numbering, identification, inspection and other marking where two or more characters are required.

Send for Literature and Prices

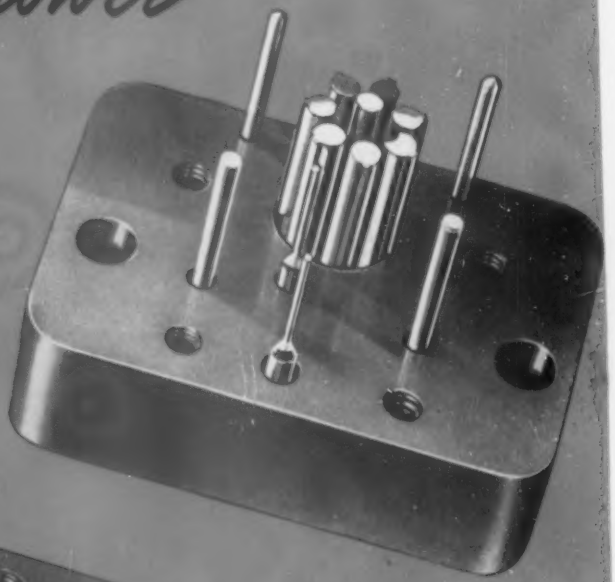
M.E. CUNNINGHAM CO.
SAFETY STEEL STAMPS
169 E. CARSON STREET PITTSBURGH, PA.

TODAY'S *Keynote*

PRODUCTION ECONOMY

TODAY'S *answer*

INVARO



These Invaro oil-hardening steel blanking dies are meeting a difficult requirement of close tolerance—held to .003 after heat treating . . . no tendency to shrink, warp or change dimensions. Uniform hardness and long life mean high production at low cost. Look into Invaro for operations such as blanking, punching, forming, piercing, perforating.

Call

Firth Sterling

STEEL & CARBIDE CORPORATION

McKEESPORT, PA. • NEW YORK • HARTFORD • PHILADELPHIA • PITTSBURGH • CLEVELAND • DAYTON • DETROIT • CHICAGO • LOS ANGELES

ANOTHER EXCLUSIVE HYPRO FEATURE

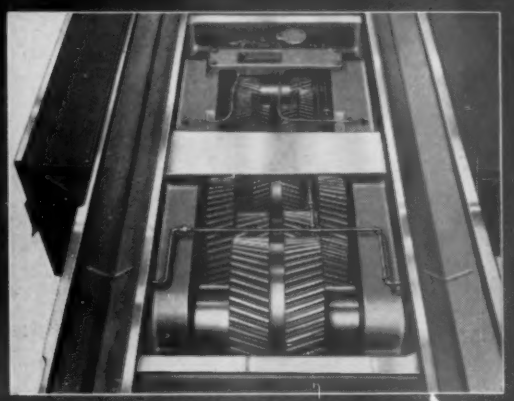
Complete Herringbone Twin Gear Table Drive

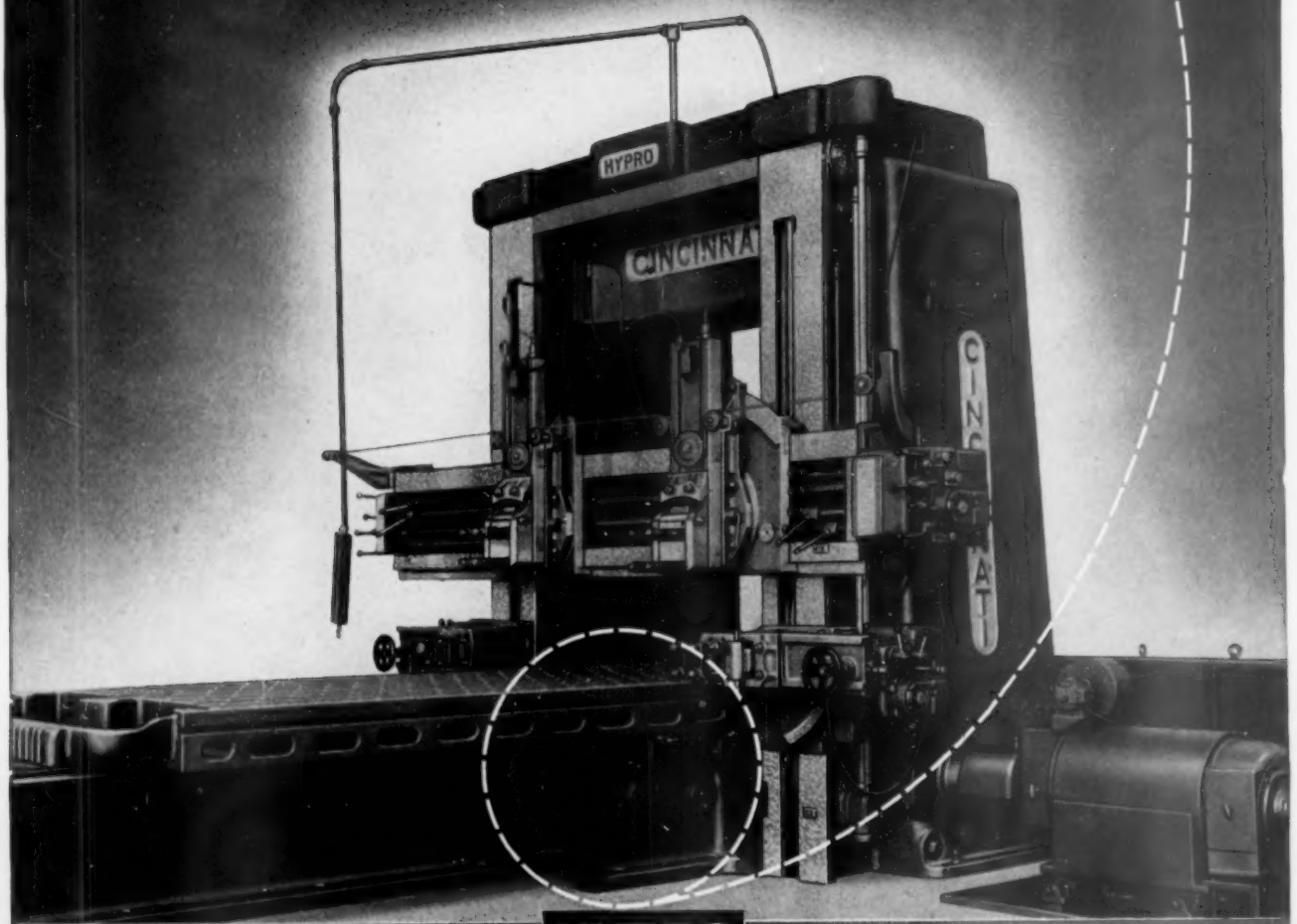
In no other planer will you find the complete steel herringbone twin gear table drive.

The twin gear train, including the bull wheel and rack, is of the herringbone type. This construction gives a smooth, continuous and even flow of power through greater tooth surface and eliminates side thrust.

There is no shock when the load is transferred from tooth to tooth, eliminating practically all wear. The gears work silently and without vibration on their large diameter shafts which are hardened full length and ground at the journals. All gears and pinions are made of steel and flame hardened.

This is one of those exclusive features that make the Cincinnati Hypro a buyer's choice.





THE CINCINNATI HYPRO PLANER COMPANY

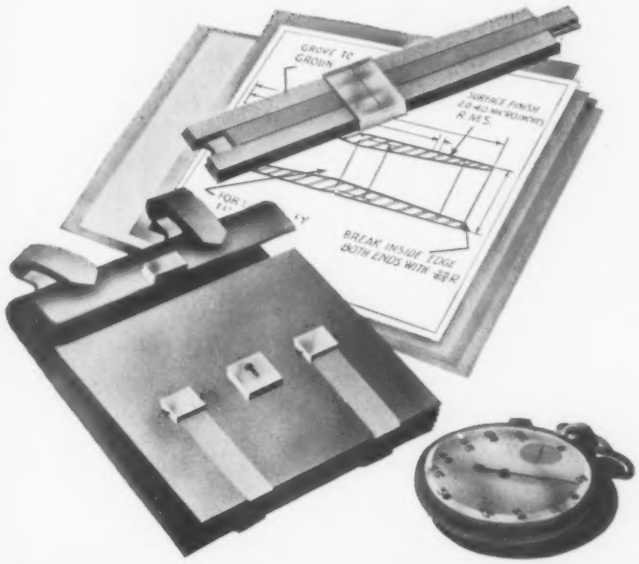
PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

A BUYING GUIDE FOR ABRASIVES

POINT No. 3

ABRASIVE ENGINEERING



For an increasing number of abrasive users, the suggestion to "Call in CARBORUNDUM" is becoming a standard practice. In many cases, it means calling in our Abrasive Engineers to discuss specific abrasive applications.

Here is a group of specialists well qualified to step in where there are unusual or difficult problems involving grinding, sanding or finishing. Often the information they pass on to both operators and production management is especially helpful... a fact reflected in the preference of so many plants, both large and small, for abrasives by CARBORUNDUM. The Carborundum Company, Niagara Falls, New York.

CARBORUNDUM

TRADE MARK

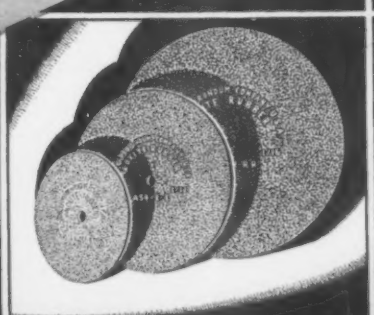
BONDED ABRASIVES

COATED ABRASIVES

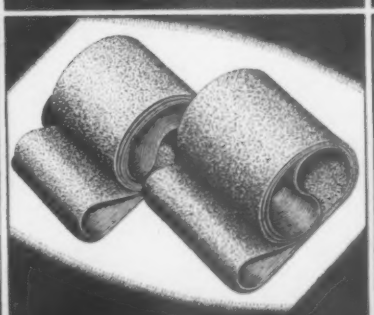
ABRASIVE GRAINS AND FINISHING COMPOUNDS

Tool Room sticks and stones that cut fast... last long... and hold their form.

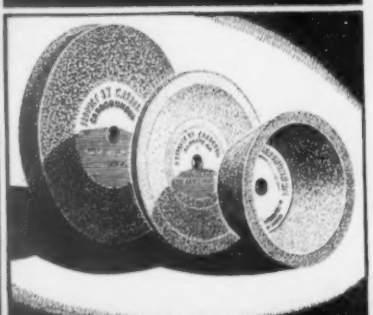
Mounted wheels, in all standard grits and grades, for portable grinding equipment



Cutting-Off Wheels... the modern tool for faster, less costly, more finished cuts.



A Coated Abrasive for every sanding and finishing condition.



All standard shapes are supplied in grinding wheels by CARBORUNDUM

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company.

PREFERRED FOR PRACTICAL REASONS

STA-KOOL

TOOL HOLDERS

30 to 50% Longer Tool Life is obtained with the JKS STA-KOOL Tool because of its internal ducts and fins which permit quantities of coolant to circulate in and around the setting. Temperature is thus kept well below the danger line, increasing diamond life. Available for practically all makes of machines.

SMITITE

DIAMOND TOOLS

Resetting Costs are Eliminated in straight dressing operations with the use of JKS SMITITE Tools. Carefully selected, small stones are set for life in matrix that slowly wears away with the diamonds. Fresh cutting edges are always obtainable by a simple turn of the tool, until the diamonds are entirely consumed.

For further information on the above tools or the complete JKS line of diamond tools, write

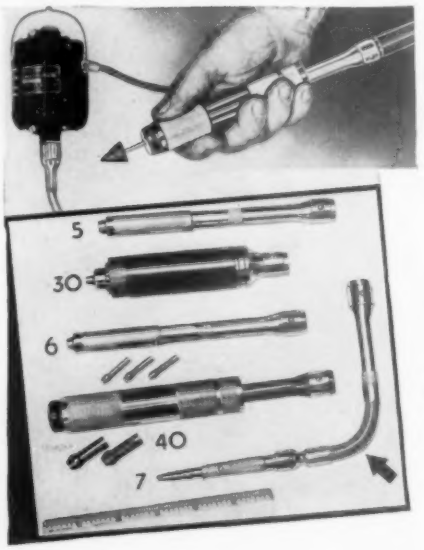
J. K. SMIT & SONS, Inc.

157 Chambers St., New York 7, N. Y.
6400 Tireman Ave., Detroit 4, Mich.

302b

How to Save Man-Hours in Deburring and Finishing of Small Parts

FOREDOM Flexible Shaft MACHINE



5 quickly interchangeable handpiece types—pencil sizes and larger—some with flexible wrist—see arrow.

Pencil-size handpieces for the hard-to-reach places. Larger, ball-bearing handpieces for the heavier jobs, all quickly interchangeable. Flexible shafts which really ARE FLEXIBLE. Suspension models as well as bench models.

3 WAYS Right!

1 For de-burring, grinding, finishing, polishing and other light production jobs — particularly valuable on irregularly shaped parts.

2 For grinding, finishing and touching up dies, molds, jigs, etc.

3 For touching up set-ups without disassembly, removing high spots on gears, identification marking of equipment, etc.

Ask your mill supply dealer regarding FOREDOMS. If he cannot supply, write us direct.

Write for Catalog No. 58

FOREDOM ELECTRIC CO.

27 PARK PLACE, NEW YORK 7, N. Y.

Another development of
PARK Research Laboratories . . .

New NEUTRA-GAS PROCESS* FOR MAINTAINING NEUTRALITY OF CHLORIDE-BASE SALT BATHS!

● Latest development of Park's research laboratories is the new Neutra-Gas Process . . . a simple, efficient, economical method of maintaining absolute neutrality in chloride-base salt baths. Suitable for use between 1350° and 1700° F., the new Process completely eliminates objectionable oxides simply by periodically passing small amounts of harmless gas through the molten salt.

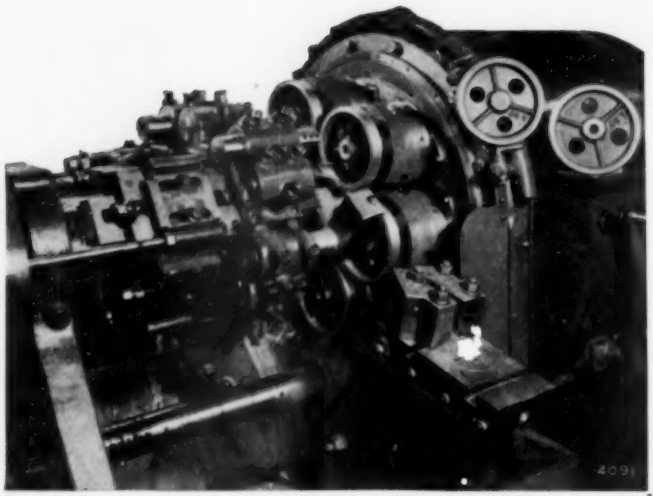
No rectifiers are required . . . sludging is eliminated . . . and no fresh salt additions are needed except to replace drag-out. Further, the Process maintains original fluidity of the bath and work leaves as clean as when it entered. Write today for our Technical Bulletin No. H-25. It tells the whole story.

*Patent pending

● Liquid and Solid Carburizers ● Cyanide, Neutral, and High Speed Steel Salts ● Coke ● Lead Pot Carbon ● Charcoal ● No Carb ● Carbon Preventer ● Quenching and Tempering Oils ● Drawing Salts ● Metal Cleaners ● Kold-Grip Polishing Wheel Cement

LICENSED MANUFACTURER: Electric Resistance Furnace Co., Ltd., Weybridge Surrey, England

Park
CHEMICAL COMPANY
8074 Military Ave., Detroit 4, Mich.



GEAR BLANKS ARE TURNED ACCURATELY AND SPEEDILY ON

"BAIRD" AUTOMATIC CHUCKING MACHINES

Here is shown a "Baird" No. 76H Chucking Machine, set up for turning, facing and boring gear Blanks made of a Special Cast Iron having a Rockwell hardness—85—90 B Scale.

The O.D. is finished turned to 6.800 plus or minus .001 and both faces are finished to 1.000 width, plus or minus .001.

The Hole is finished bored and reamed .750 diameter to plug gage and is concentric with the O.D. turning within .001 total indicator reading.

The work is held in Standard "Baird" Three Jaw Contracting Chucks, using stud type jaws for gripping. (The Spindle Turret is shown partially indexed to better illustrate the method of chucking.)

This gear is completely turned as shown to the required accuracy at the rate of 55 pieces per hour.

Selection of a spindle speed for each position, which is a special Baird Feature, permits high Spindle speeds in the finishing positions where carbide tools are used to produce the fine accurate surfaces required.

When you have Turning Operations that should be done profitably

"ASK BAIRD ABOUT IT."

THE BAIRD MACHINE COMPANY
STRATFORD, CONN.

LUSTY PRECISION LIVE CENTERS

#1 to #7 Morse Tapers

FRICTIONLESS

The #7 illustrated (5" body diameter) is husky enough for largest heavy duty railroad shop equipment.

Smaller body sizes range down to 2 1/16" diameter for use on smallest tool room lathes.

LOADS AT 100 R.P.M.

Radial
1047 to 7275 lbs.
Thrust
197 to 3460 lbs.

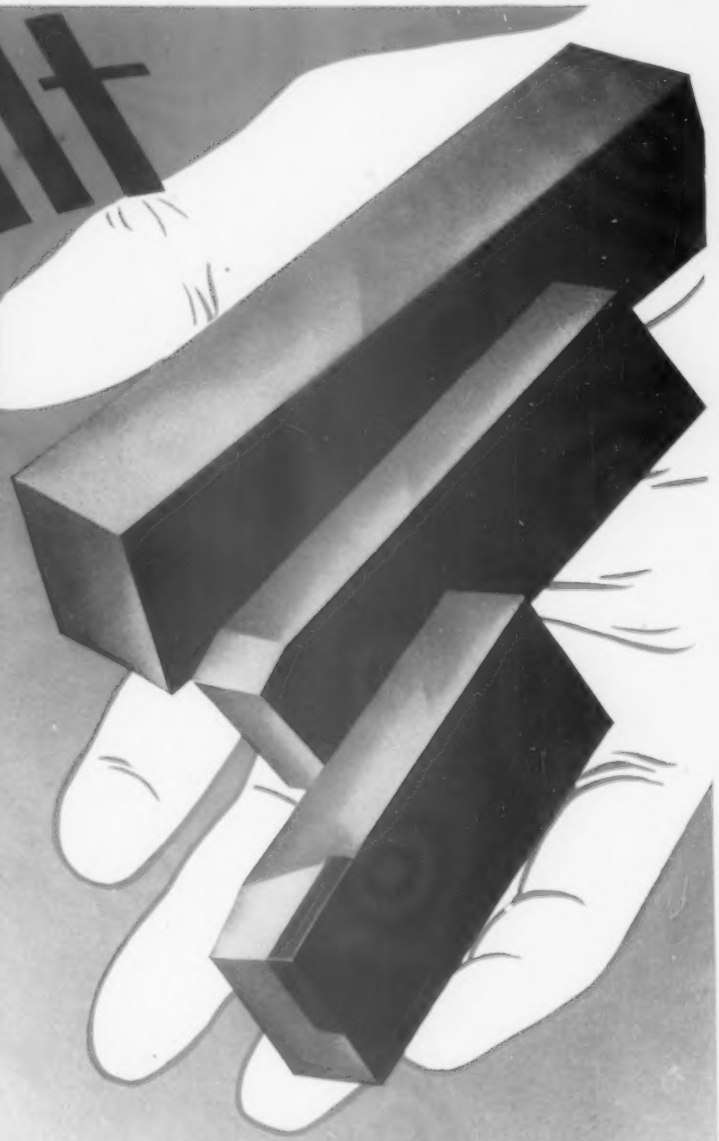
Utility Tools

SLIP-IN TYPE
SPINDLE TYPE
SLIP-OVER TYPE
TAPER SHANK TYPE

These GLENZER "PRECISION" LIVE CENTERS turn with the work and run on replaceable Timken Roller Bearings in oil. All bearing surfaces are hardened and ground. Front bearing seats on resilient pad to absorb shocks—reduce tool breakage.

THE J. C. **GLENZER** CO., Inc.
6467 EPWORTH BLVD. DETROIT 10, MICH.

Crobalt Quality



Crobalt is a hard alloy (containing principally chromium, cobalt, tungsten, vanadium, zirconium and carbon), cast in the form of tool bits and inserted milling cutter blades especially developed for high speed production. At high temperatures (up to 2000 degrees) Crobalt cutting qualities remain constant.

The cutting edges of a Crobalt tool stay sharp longer, and thus assure you of much greater tool life between grinds. This automatically increases production by reducing "Down-time" ordinarily required for changing of tools. Try Crobalt in your shop.

CARBIDE TIPPED
Inserted Milling Cutter Blades

Crobalt now fabricates carbide tipped inserted milling cutter blades. Any make of tungsten carbide can be furnished. Prices for this type of blade are unusually low and the product and finish are unexcelled. We manufacture blades of all types and sizes. Send us your prints for quotation.

Crobalt Inc.

1351 N. Main St. **Ann Arbor, Mich.**

PERFECT HOLES

- A NEW INVENTION!
- A NEW MACHINING METHOD! ROTARY BROACHING *
- A NEW NAME-"**ROTARY BROACH**" *

ROTARY BROACHES may be used in lathes, turret lathes, automatics, drill presses, etc., to replace reamers. They produce perfect holes with finishes that can only be compared to honing. They last longer before grinding is necessary and may be resharpened 10 to 30 times. They produce perfect holes at a fraction of the cost of those produced by other methods Eliminates grinding, lapping, honing and boring.

USE THIS NEW MACHINING METHOD—ROTARY BROACHING*

You Cannot Afford Not To Use Rotary Broaches (Write for free descriptive literature)

*** "Rotary Broach" and "Rotary Broaching" are new names coined and copyrighted by Shearcut Tool Company.**

Patented in Canada. United States and Foreign Patents Pending

SHEARCUT TOOL COMPANY

DEPT. D-3, RESEDA, CALIFORNIA

ORDER THROUGH YOUR NEAREST INDUSTRIAL SUPPLY HOUSE

Warehouses
District Offices

Nationally known

High Speed Steels

★ **Red Cut Superior**
America's best known tungsten high speed steel—for all cutting purposes.

★ **Red Cut Cobalt**
Extra Duty—heavy cuts, fast speeds, hard or abrasive materials.

★ **Gray Cut Cobalt**
Super Duty—hogging cuts, high speeds, heat treated or abrasive materials.

★ **Vasco M-2 and 6-6-2**
Tungsten-Molybdenum general purpose steels.

★ **Neatro**
Superior Wear Resistance—delivers top performance on non-ferrous materials, cast steel, cast iron, heat treated steels.

★ **Vasco Supreme**
Entirely New—higher hardness, higher wear resistance, higher hot hardness, higher speeds.

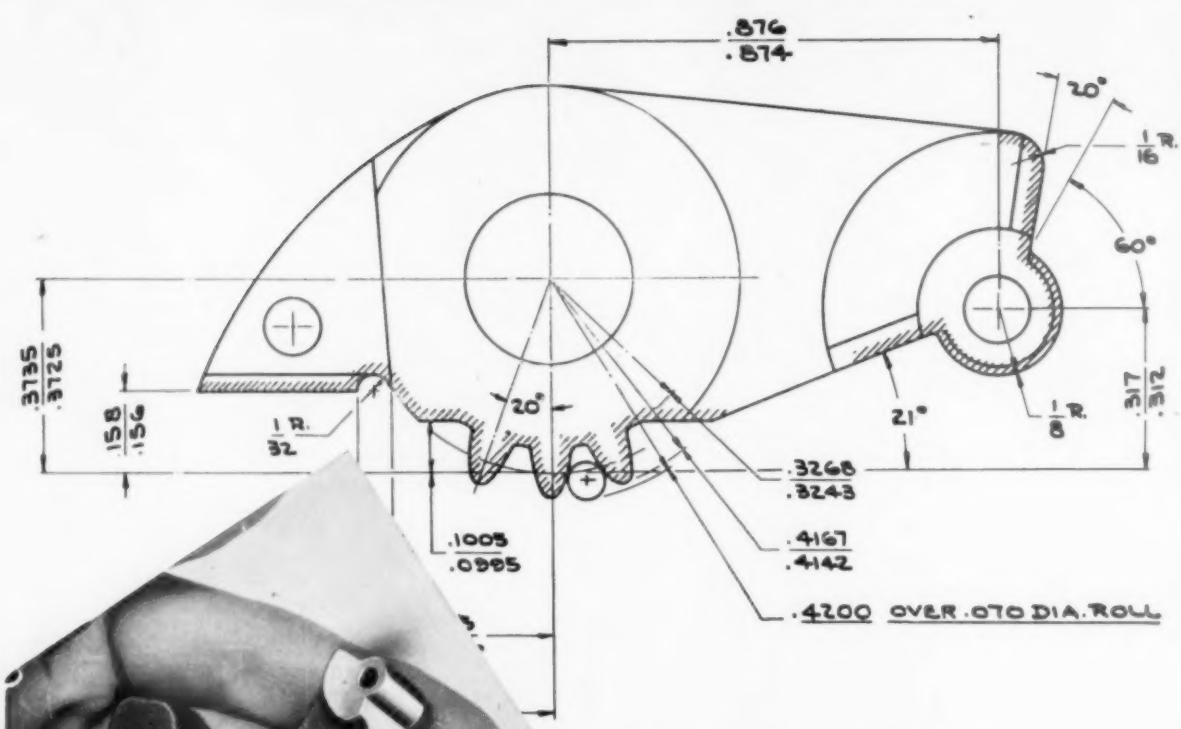
FIRST QUALITY TOOL STEELS

Our Latrobe, Pennsylvania plant is the only steel mill in the world devoted *exclusively* to the manufacture of high speed steel.* No wonder you are assured of steels free from harmful segregation—free from harmful decarburization—free from contamination. No wonder Vanadium-Alloys steels are the *first choice of most manufacturers* of drills, reamers, taps, broaches, milling cutters, form tools, hobs, chasers, counterbores...wherever maximum performance is a necessity!

*Carbon and alloy tool steels are produced by our Colonial Steel Division.

Vanadium-Alloys
STEEL COMPANY
LATROBE, PENNA.

Colonial Steel Division Anchor Drawn Steel Co.

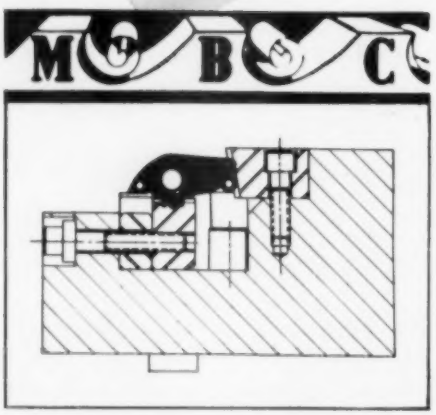


What's so different about *this* part?

Just this—The job was engineered—the tools were built and the part was machined by ONE SOURCE, MICHIGAN BROACH.

This same "*complete service*" is being performed daily for many customers and being performed at reduced costs. MICHIGAN'S "know how" in *designing, building* and *using* broaches makes this possible.

MICHIGAN, long recognized as one of the industry's most reliable sources for broaches, fixtures and gages, also operates the largest commercial machine shop of its kind in the country for *furnishing complete parts.*



Four milling operations were required to machine this contour. It was broached in one operation. Broaching is faster, reduces scrap, requires less skilled labor.

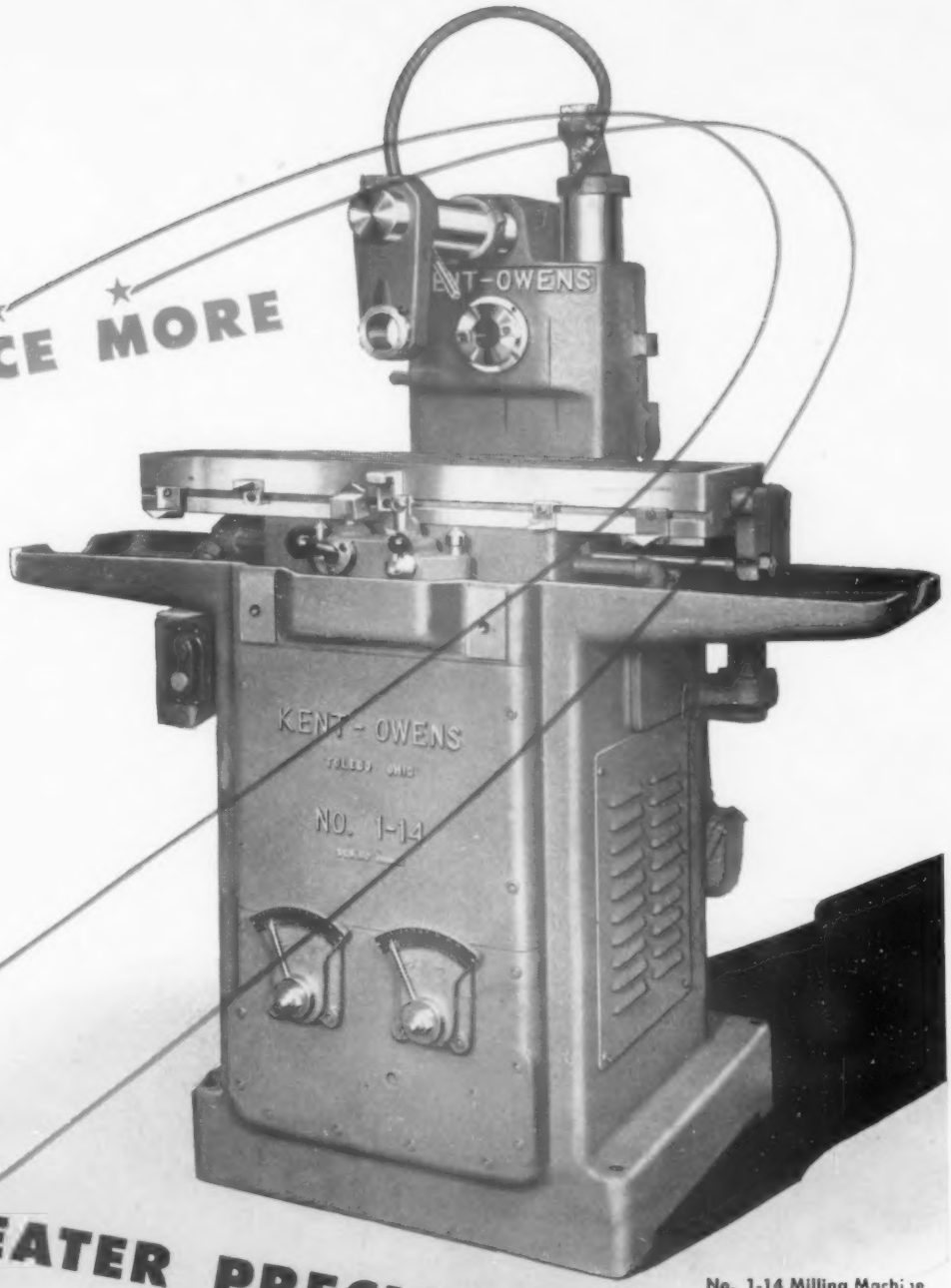
Send your next part to MICHIGAN for machining or have MICHIGAN quote on furnishing it complete.

The new NUMBER 8 folder is off the press. Write for your copy. It deals with an interesting phase of broaching.

MICHIGAN BROACH CO.

10367 NORTHLAWN AVENUE **DETROIT 4, MICHIGAN**

PRODUCE MORE



WITH GREATER PRECISION

No. 1-14 Milling Machine
Table, 32" x 9"
Table travel, 14"

Put the work on Kent-Owens Milling Machines for *efficient* production . . . at *top speed* . . . with *high accuracy!* These machines designed for rapid, easy set-up and operation. Rugged . . . with twin-post head mounting that assures balanced load—no chattering. Practical features throughout get the O.K. of the good machinist.

The Kent-Owens Standard line includes a wide range of hydraulic and hand operated machines. Also, Kent-Owens builds special machines for many types of work. Let a Kent-Owens engineer recommend machines and tooling best suited to your requirements. Consult us about your needs. Kent-Owens Machine Company, Toledo, Ohio.

Call on KENT-OWENS

for Milling Machines

WHERE HAVE YOU SEEN PRICES LIKE THESE?

Adjustable MULTIPLE SPINDLE DRILL HEAD

Adaptable to 14" x 17" Machines
6" Drilling Area

HEAD CAN BE FURNISHED WITH 3 TO 8 SPINDLES

1/4 CAPACITY
21/32 CENTERS

PRICES

3	Spindle	Head	$150.00	6	Spindle	Head	$170.00
4	"	"	155.00	7	"	"	180.00
5	"	"	160.00	8	"	"	200.00

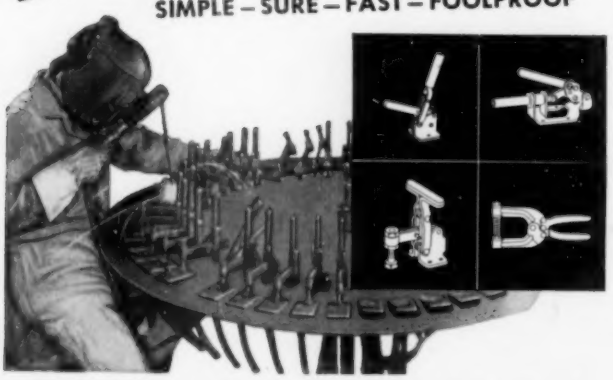
US HEADS SINCE 1915

• *Delivery in Two Weeks*

UNITED STATES DRILL HEAD CO.
CINCINNATI 4, OHIO

SMART TOOLING!

SIMPLE – SURE – FAST – FOOLPROOF



Here's efficient tooling based on the quick action and positive holding power of De-Sta-Co Toggle Clamps. This simple turntable with its 48 No. 210-S clamps enables one welder to keep abreast of two helpers. One places curved shank in socket and unloads finished assemblies. The other locates pierced hole in plate over shank and locks securely with toggle clamp. The expert welder works without interruption.

Smart tooling like this is the backbone of modern mass-production technique. You'll see De-Sta-Co Toggle Clamps playing vital parts *wherever* the principles of sound tool engineering are observed.

Welding production is *only one* of the many fields for quick acting clamps. For holding parts in milling, drilling, routing, riveting, cementing—for fast, uniform, *foolproof* action—progressive tooling demands De-Sta-Co adaptability and quality. There's a De-Sta-Co clamp for every job, designed and built to stand up under the wear and tear of volume production. Send for copy of Catalog No. 47.

DETROIT STAMPING COMPANY
328 Midland Ave. Detroit 3, Mich.

On metal, wood, glass, plastics

FOR FINE DETAILS
• CLOSE TOLERANCES
• PRECISE FINISHING

A WHOLE SHOPFULL OF TOOLS IN ONE

Machinist - craftsmen find it unsurpassed for grinding, drilling, routing, carving, sanding, polishing and 9,994 other uses. Precision-engineered, AC - DC, with more exclusive features than any other tool.

Exclusive finger-grip brings hand closer for finer work

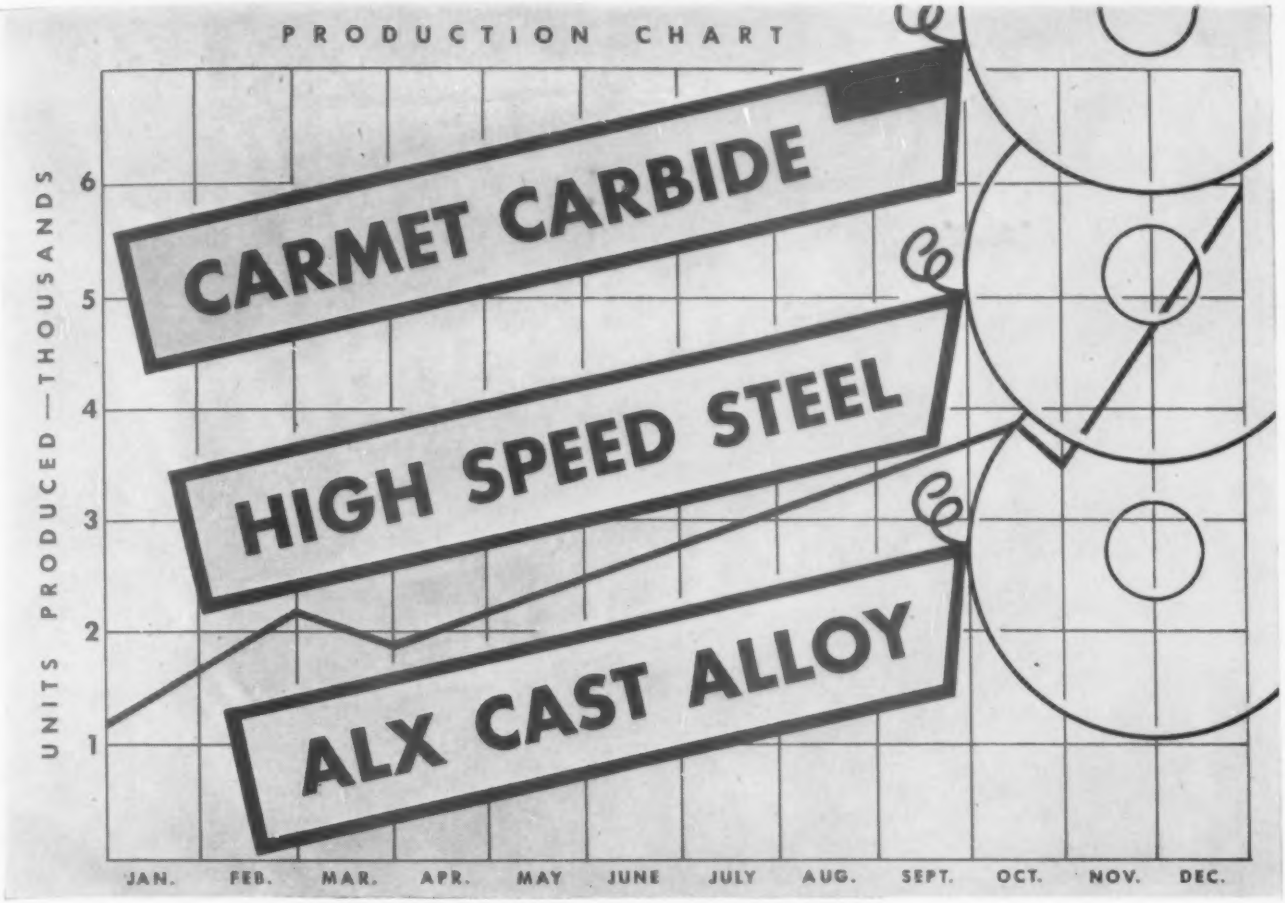
Complete with 36 accessories in fitted steel case

$22.50

$31.75 value if purchased separately

CASCO Electri-Craft Tool Kit

CASCO PRODUCTS CORPORATION • BRIDGEPORT 2, CONN.



Which CUTTING TOOL MATERIAL WILL DO *Each* OF YOUR JOBS *Best*?

Allegheny Ludlum offers you—*from one source*—a choice of *every* type of cutting material . . . each in a wide and complete range of grades and sizes. That means a better opportunity for you to pick the tools *best* suited to each of your production jobs—with resultant savings in production time and costs. There's real value for you in one source for all your cutting tool requirements, plus a competent Mill Service Staff to assist your selection. • Write today—on your company letterhead, please—for our new, full-color booklet on "Cutting Tool Materials." You'll find it a big help in your production plans.

SEND FOR THIS NEW BOOK

ADDRESS DEPT. TE-52.

ALLEGHENY LUDLUM

STEEL CORPORATION • Pittsburgh, Pa.

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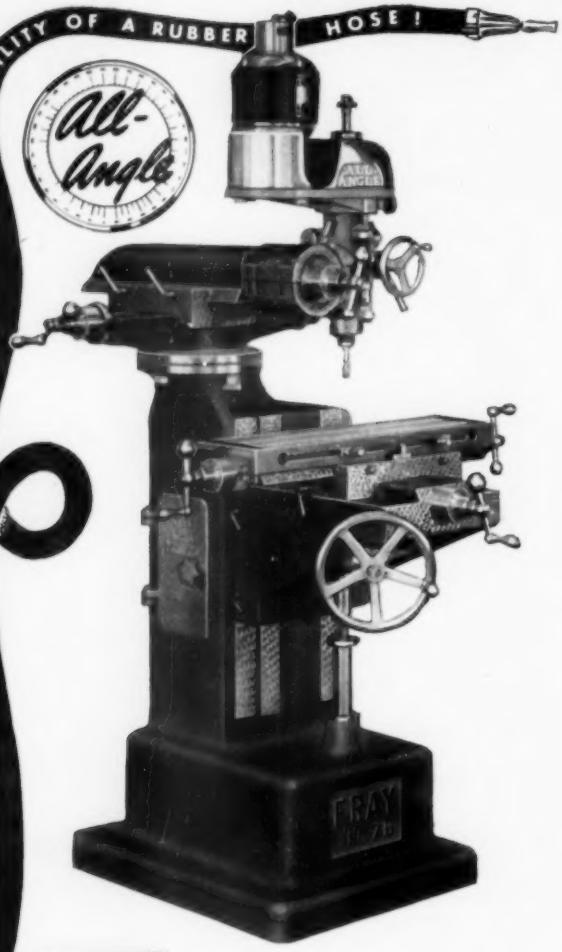
Fine Tool Steels Since 1854

W&D 994

FLEXIBILITY OF A RUBBER HOSE!

All-Angle



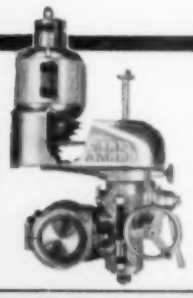
Fray

PRECISION RAM TYPE NO. 7-B

VERTICAL UNIVERSAL

MILLING MACHINE

- Flexible
- Sturdy
- Universal
- Easy to operate
- One set up
- All angles quickly obtained



- Four Sizes
- Four Types
- Adaptable to all Milling Machines

For further information write Dept. H

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H. LEACH MACHINERY CO.

387 CHARLES ST. PROVIDENCE 4, R. I.

AGENTS IN ALL PRINCIPAL CITIES

That Unseen Extra Quality

Exclusive!

WITH REPUBLIC!

REPUBLIC GAGE COMPANY'S adjustable ring gages are scientifically drawn at the spring holes by electricity . . . The use of this exclusive patented process eliminates distortion and strain caused by the usual method of drawing. Out of roundness is minimized due to the small area of pivotal adjustment.

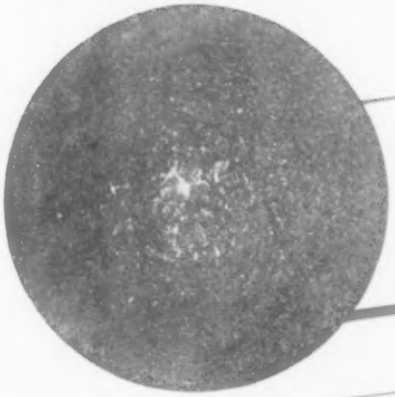
Republic's products with "THAT UNSEEN EXTRA QUALITY" cost no more.

RELY ON REPUBLIC

REPUBLIC GAGE

DETROIT 21, MICHIGAN

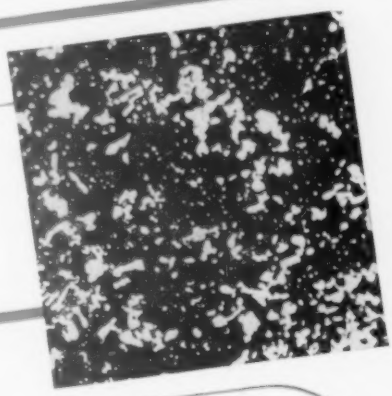
LATROBE presents an interesting PHOTO-QUIZ!



WHAT DOES THIS SHOW?

A

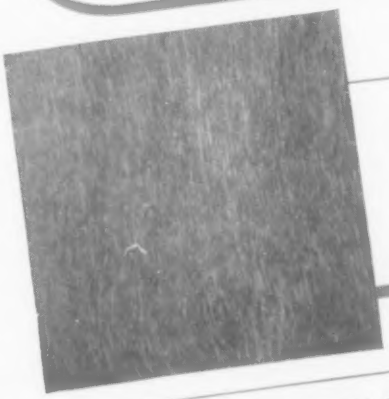
1. A view of the moon?
2. A photo of ordinary high speed steel bars?
3. A picture of a drop of "heavy" water?



WHAT IS THIS?

B

1. An air-view of Hiroshima after the A-bomb was dropped?
2. A photomicrograph of standard process high carbon-high chrome die steel?
3. A view from the air of the frigid wastes of the North?



WHAT WOULD YOU SAY THIS IS?

C

1. A photo of a hob forging, free from the usual carbide segregations?
2. A piece of circassian walnut?
3. A cross-section of a giant redwood?

DESEGATIZED

WHAT DOES THIS WORD MEAN?

D

1. A product that has been defrosted?
2. A piece of candy from which the sugar has been extracted?
3. A trade-mark for a new and important dispersed-segregate steel?

Correct Answers

A-2 This photo shows the structural condition of the center of a standard 18-4-1 type high speed steel bar, with the usual carbide segregations readily apparent. Such segregations have been the main factor in tool failures in the past.

B-2 This photomicrograph of a hardened disc of standard high carbon-high chrome die steel, magnified 250 times, again demonstrates carbide segregations in a center section a detriment to machineability, heat treatment and life.

C-1 This sectional view shows a hob forging free from central carbide segregations, heretofore impossible until . . . Well, why get ahead of our story.

D-3 LATROBE recently developed a new process in the manufacture of High Speed Steels and certain types of Die Steels, which assures a steel free from carbide segregations. Steels thus made are called dispersed-segregate steels, meaning that the carbides *are dispersed throughout* and not grouped near the center in a brittle mass. This, in turn, assures more uniform quality, better performance, longer life! Latrobe's trademark for these steels is *DESEGATIZED*.

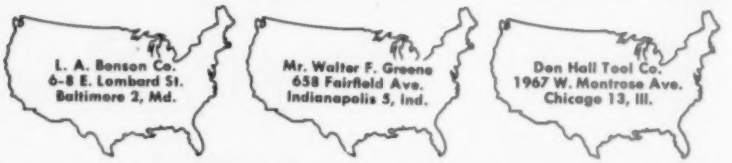
Write for latest bulletins!

2

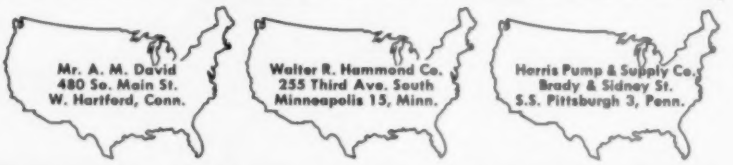
LATROBE ELECTRIC STEEL COMPANY • LATROBE, PENNSYLVANIA

NATIONWIDE *Lovejoy Service*

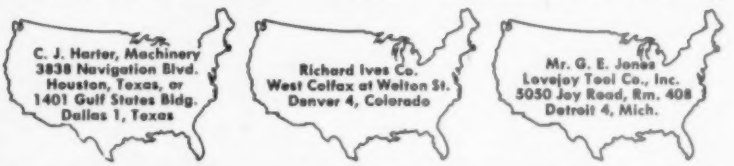
IF YOU ARE INTERESTED IN SERVICE ON



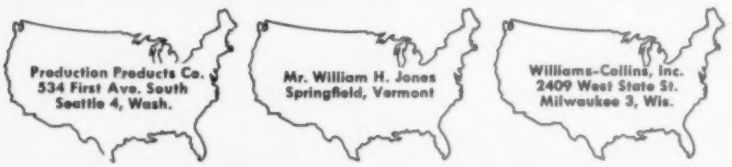
LOVEJOY MILLING CUTTERS AND ARBORS,



BORING HEADS AND COUNTERBORES,

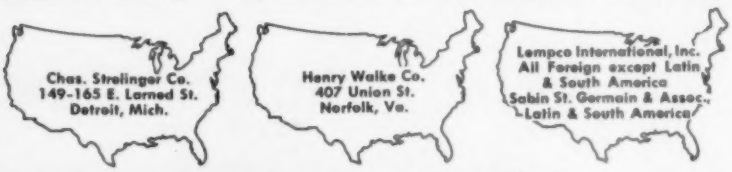


SPOT-FACING TOOLS, ETC., THERE IS A



LOVEJOY ENGINEERING REPRESENTATIVE

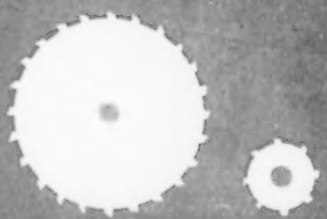
NEAR YOU—WILLING AND ABLE TO HELP



WITH PRODUCTION PROBLEMS

DESIGN

A complete engineering service, backed by an experienced staff, is at your service to make recommendations and design special cutters.



RANGE

Hundreds of sizes, dozens of models to meet every requirement, regardless of machines used or materials to be cut.

SERVICE

Even special tools use standard parts which are stocked by us. There are 20 Lovejoy service centers throughout the U.S.A.—there is one near you.

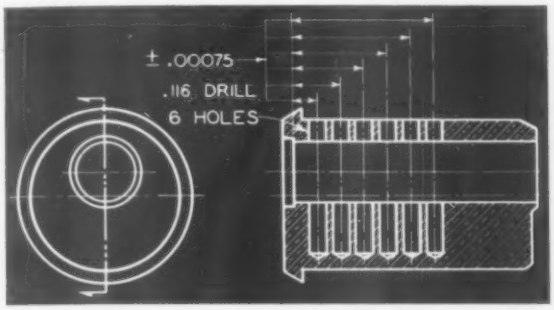
30 YEARS' SATISFACTION

Nearly 30 years' continuous experience making milling cutters and other "Positive-Locking" tools. Our first customers are still buying our tools.

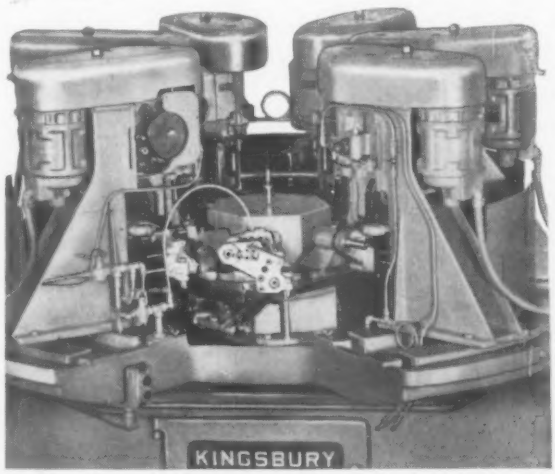
LOVEJOY TOOL COMPANY, INC.
SPRINGFIELD, VERMONT, U. S. A.

MULTIPLE DRILLING FOR HIGH PRODUCTION

PROBLEM Drill 6 parallel holes in brass lock cylinders, locating each hole within ± .00075.

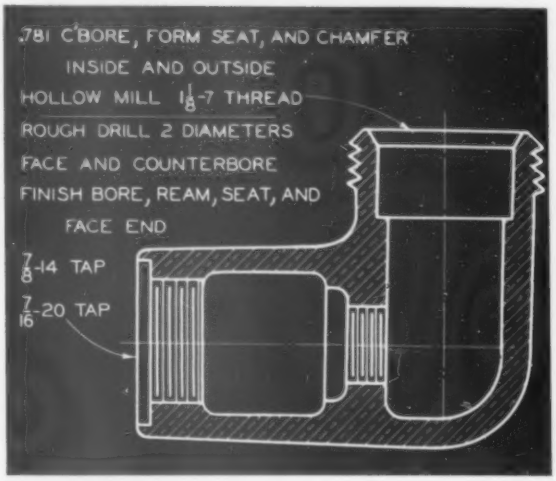


METHOD ± .00075 ACCURACY IN LOCATION for each hole is obtained by drilling every hole without disturbing the work. Furthermore, the tool guide bushings are supported in plates that are piloted onto the fixtures. Each piece is chucked in one of seven identical fixtures, indexed automatically to each drilling unit, and automatically ejected.

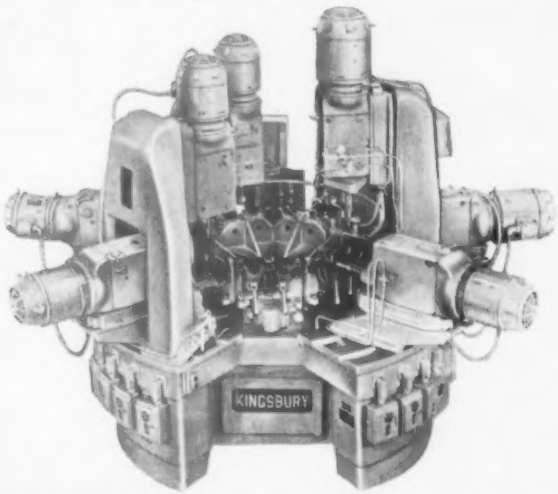


RESULTS 1,000 PIECES PER HOUR GROSS, with one operator, excellent quality control, less handling and less floor space. The use of individual standard units lowers the first cost and permits the utmost efficiency for each operation. These savings quickly pay for the machine.

PROBLEM Machine each corner of 2-way and 4-way brass shower valve units.


.781 C'BORE, FORM SEAT, AND CHAMFER INSIDE AND OUTSIDE
HOLLOW MILL 1 1/8-7 THREAD
ROUGH DRILL 2 DIAMETERS
FACE AND COUNTERBORE
FINISH BORE, REAM, SEAT, AND FACE END
7/8-14 TAP
7/16-20 TAP

METHOD WITH ONE CHUCKING PER CORNER all operations are completed on this 9-spindle automatic indexing machine. Each of the seven identical fixtures on the index turret holds the valve units in different positions for machining each corner.



RESULTS 600 CORNERS PER HOUR GROSS with one operator.

If multiple drilling operations up to five hp each are required on your high production work, we can design, build and tool automatic machinery all ready to be installed and started up. Just send us the prints showing the operation and hourly production and ask for proposals.

Kingsbury Machine Tool Corporation, Keene, N. H.

KINGSBURY

To eliminate vibration...

GISHOLT DYNETRIC* BALANCERS

Locate and measure the cause, for quick and easy correction of unbalance

Whatever it is—if it rotates, it can be balanced by a Gisholt Dynetric Balancing Machine.

Using electronic means of amplification, the Dynetric picks up unbalance vibrations as small as .000025″, locates the source and measures the amount of unbalance by a simple meter indication—all in a matter of seconds.

For the balancing of many parts such as brake drums, cream separator bowls, flywheels, etc., the vertical Type S Dynetric Balancer, shown above, provides utmost ease in mounting and removing work for volume production. It is one of many sizes and types which handle parts weighing from a fraction of an ounce to many tons.

If your product can be improved by eliminating vibration, a Gisholt Dynetric will provide the quickest, most accurate means known for checking and removing the cause—*unbalance.*

**Developed jointly with Westinghouse Electric Corporation.*

GISHOLT MACHINE COMPANY
1245 E. Washington Avenue • Madison 3, Wisconsin

THE GISHOLT ROUND TABLE
represents the collective experience of leading specialists in the machining, surface finishing and balancing of round and semi-round parts. Your problems are welcomed here.

TURRET LATHES • AUTOMATIC LATHES • BALANCERS • SUPERFINISHERS • SPECIAL MACHINES

RED
"NOT GO"
Pat. Pending

GREEN
"GO"

NEW TESTED-ACCEPTED THREAD RING GAGES

5-PLUS FEATURES

1. Greater accuracy and stability
2. Longer wear life
3. Less weight
4. Positive identification
5. Positive adjustment

ACCURACY YOU CAN TRUST

WOODWORTH RING GAGES STILL PROVING "ON THE JOB" SUPREMACY OVER ORDINARY GAGES

No wonder more and more industries are adopting this gage as standard. Its revolutionary design assures wear life 5 to 7 times longer. And maintains accurate inspection.

This *proved* gage is easy to adjust, light in weight, durable—it's a *must* for cutting costs, increasing production. Just try the Woodworth Thread Ring Gage on your extra tough job—and you, too, will standardize!

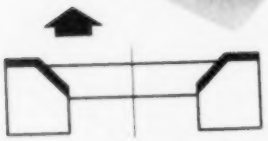
Wire or write for folder No. 46R at no obligation.

WOODWORTH

N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD • DETROIT 20, MICHIGAN

PRECISION GAGES • PRECISION MACHINE PARTS • DIAPHRAGM CHUCKS • ADJUSTABLE CLAMPING JIGS • SPECIAL TOOLS

Take a Tip FROM US...

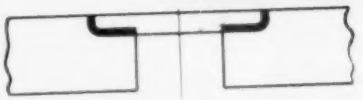


A common application in counterboring—chamfers and faces.

ECLIPSE CEMENTED TUNGSTEN CARBIDE TIPPED TOOLS ARE TOPS

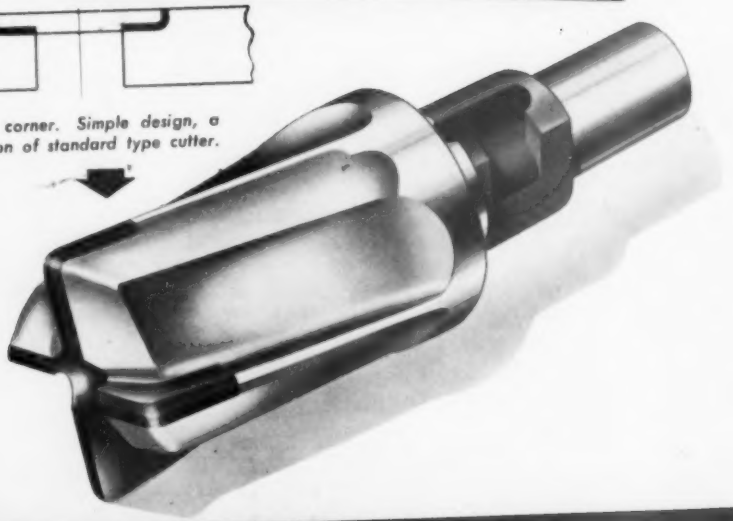
Just try the rugged Eclipse carbide tipped tools and you'll never settle for less. Thousands of them are in daily use in production machining of steel, iron, brass, aluminum and other materials cast and forged. Eclipse engineering experience is available at all times. Send your production problems to us.

If you have not received a copy of our new catalog, order one on your letterhead today.



Radius corner. Simple design, a variation of standard type cutter.

Used in machining aluminum alloy. Finishes five surfaces.



ECLIPSE COUNTERBORE CO.

Founded thirty years ago

DETROIT 20, MICHIGAN

Save set-up time with this "Magic" Quick-Change Chuck. Presto-Change-O, you change tools in your Drill Presses, Vertical Tapping and Boring Machines... insert Drills, Reamers, Boring Bars, Counterbores, Core Drills, Taps or Special Tools, without stopping spindles!

When you raise locking ring, collet drops out automatically for a quick, safe tool change. Four styles of collets available —"AA", "A", "D" and "E" to accommodate various tools. Adds many stations to your machines.

Consult our engineers on adapting "Magic" Quick-Change Chucks and Collets to your production problems. Send us your sketches or blue prints for recommendations and quotations.

A good stock of Quick-Change Chucks is maintained from which requirements for most sizes can be filled immediately. See pages 98-102 of Scully-Jones Catalog No. 500.

Refer to the Scully-Jones Catalog showing over 500 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

Scully-Jones AND COMPANY

2140

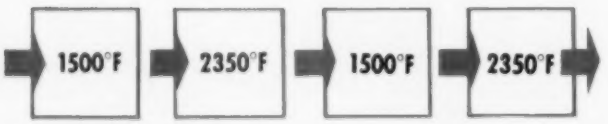
1915 SOUTH ROCKWELL STREET • CHICAGO 8, U.S.A.

ACE DRILLS
are ground from the solid

Ace Drills give longer service because the flutes are ground from solid bars that have been double-dip hardened. This method of hardening is practical only when all surface damage can be completely removed by grinding.

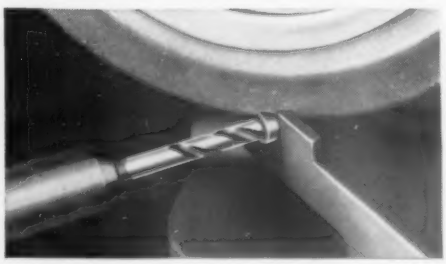
Surface damage removed by centerless grinding.

Uniform hardness and toughness is possible because the mill length bars of high speed steel are passed through the high steady heat of a 22 foot long furnace in a continuous line . . . bar after bar. The rods enter the furnace through small flame sealed openings which maintain uniform furnace conditions not possible with batch type hardening processes.



Sketch showing the 22 foot long, 4 section hardening furnace through which round bars 12 feet long are fed in a continuous line. Double-dip hardening produces a greater carbide solution while maintaining a satisfactory grain size so important to toughness. This means that more effective hardness is retained despite increased temperatures during drilling. (Do not confuse double hardening with double tempering. Ace Drills receive multiple tempering.)

The polished flutes of Ace Drills are ground into the perfectly hardened blank leaving the metallurgical structure gained in hardening undisturbed. The cutting lips are keener and more even because they are formed by the intersection of two ground surfaces rather than a milled surface and a ground surface. This increases the cutting ability of the drill and adds to the drill life by reducing the number of sharpenings.



PATENT NO. 2034814

ACE DRILL CORPORATION

GROUND FROM THE SOLID

DETROIT 27, MICHIGAN

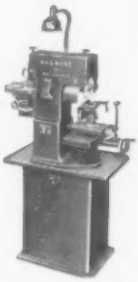
Hammond
OF KALAMAZOO

ABRASIVE BELT GRINDERS

Model VH-6WP Wet-n-Dri 6" belts. Used horizontally or vertically.

Model F-2 Flexible Belt, ½" to 2" belts. Especially suitable for irregular shaped parts.

CARBIDE GRINDERS



Model CB-77 Chip Breaker and Diamond Finishing Grinder.

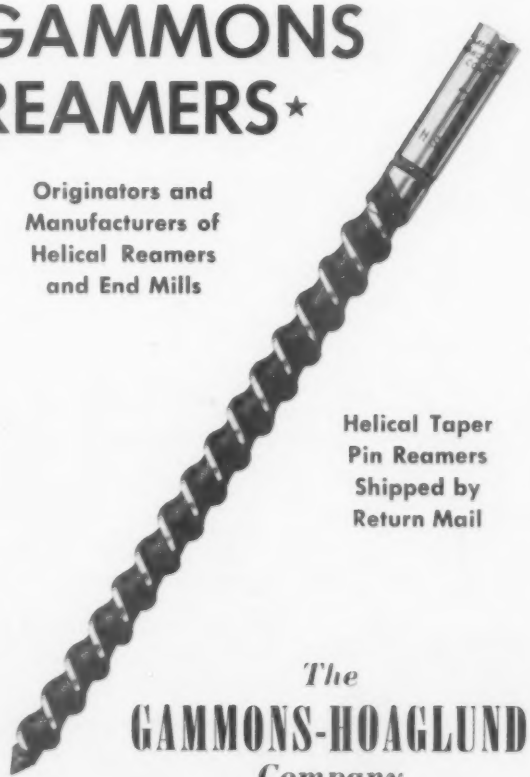
Model W-10 10" Wet Carbide Tool Grinder.

Hammond Machinery Builders INC

1661 DOUGLAS AVENUE • KALAMAZOO 54, MICHIGAN

GAMMONS REAMERS*

Originators and Manufacturers of Helical Reamers and End Mills



Helical Taper Pin Reamers Shipped by Return Mail

The GAMMONS-HOAGLUND *Company*

400 MAIN STREET, MANCHESTER, CONN.

This Little Tap Lived 7 Times Longer

● Small-sized tools no longer need be short-lived. Take this No. 2, 64-thread high-speed tap, for example. It was bought by the Webster Electric Co., of Racine, Wisconsin, to tap Dow Metal. The normal life of similar taps had been 500 to 2,000 pieces. Before putting this tap into service, it was flash-chrome plated by Racine's Lundbye Process. Then, as wear began to show up after 2,500 pieces, a second plating was applied. Later, a third was added with the result that the delicate little tool tapped *over 7,000 pieces* in all. With new taps costing $2.00 and each plating of chrome costing but 80¢, the saving was $9.60. This is just one example of hundreds of tool and money-saving jobs accomplished by Racine Lundbye Process . . . the flash-chrome finish that produces greater wear-resistant surfaces due to the extreme hardness obtained in coatings measured in millionths. Similar savings can be made in your plant.

RACINE *Lundbye Process* Chrome

GIVES TOOLS 300% LONGER LIFE

Racine Plating Company, Inc.

RACINE, WISCONSIN

HARD CHROMIUM • COPPER • COMMERCIAL CHROMIUM
NICKEL • CADMIUM • POLISHING • PICKLING

Logan A NAME TO REMEMBER WHEN YOU THINK OF BETTER LATHES

Finger Tip Control for Safety, Ease and Speed in Shifting Back Gears

BACK GEARS ENCLOSED IN HEADSTOCK

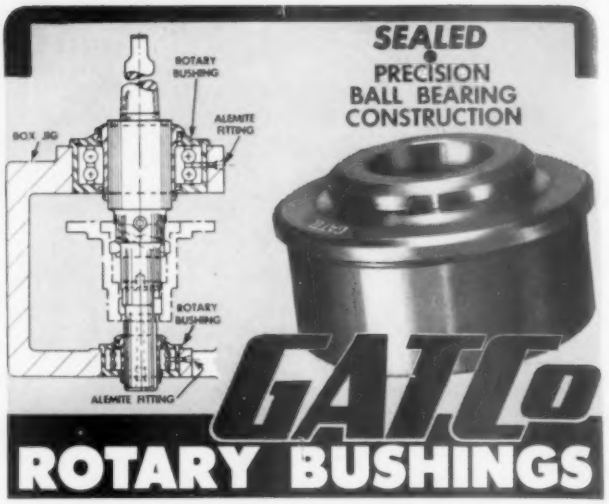
Quick Change Gear Turret Lathe

PLUS PATENTED SHIFTER RACK INCREASES SAFETY AND EFFICIENCY, ADDS TO APPEARANCE OF LOGAN LATHES

Logan advanced design encloses back gears in the headstock and places the Patented Shifter Rack at the operator's finger tips, on the front of the headstock. There is no need to reach over the headstock, or to lean forward close to moving parts to shift the back gears. The operator avoids risk and makes the shift more easily and quickly. Here is another example of the practical designing which makes Logan Lathes outstanding in accuracy, speed, durability and safety, and in trim, clean cut appearance. Write for the Logan Lathe Catalog. L-4

SPECIFICATIONS COMMON TO ALL LOGAN LATHES . . . swing over bed, 10½" . . . bed length, 43⅛" . . . size of hole through spindle, 25/32" . . . spindle nose diameter and threads per inch, 1½"—8 . . . 12 spindle speeds, 30 to 1450 rpm . . . motor, ½ hp, 1750 rpm . . . ball bearing spindle mounting . . . drum type reversing motor switch and cord . . . precision ground ways, 2 V-ways, and 2 flat ways.

LOGAN ENGINEERING CO. CHICAGO 30, ILLINOIS



SEALED PRECISION BALL BEARING CONSTRUCTION

GATCo ROTARY BUSHINGS

FOR DRILLING, CORE DRILLING, ROUGH AND FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work—or both.

Eliminates expensive tool construction—Reduces tool wear—Prevents seizure and pilot breakage—Especially adapted where precision is required.

Write for full information and prices

GIERN & ANHOLTT TOOL CO.
1302 Mt. Elliott Avenue • Detroit 7, Michigan

Here's HOW TO AVOID Bell-Mouthed Holes!

If you have become so accustomed to bell-mouthed holes that you think they are unavoidable on tapping and reaming jobs, you will quickly change your mind once you use a Ziegler Floating Tool Holder.

The most common cause of bell-mouthed and oversize holes is simply misalignment of the spindle with the work. By automatically compensating for such inaccuracies up to 1/32" radius, or 1/16" diameter, the Ziegler Holder makes it so easy to turn out perfect work that it is almost unbelievable.

Change over to Ziegler Holders and see how much easier you can turn out perfect tappings and reaming jobs!

Made To Fit Any Machine

Furnished with male or female taper, straight, threaded or special shanks to fit any machine used for tapping or reaming.

WRITE FOR CATALOG

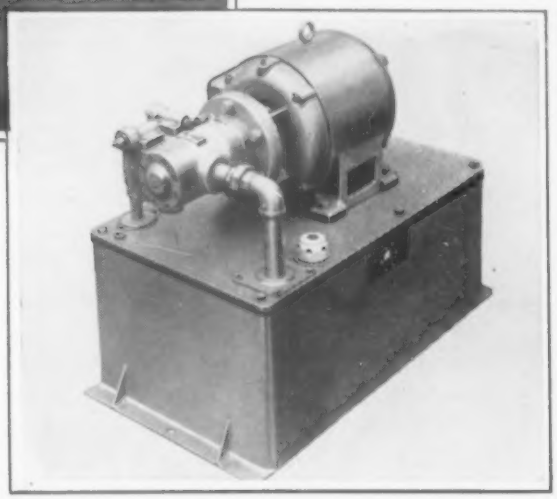
W. M. Ziegler Tool Co.
1930 Twelfth St.
Detroit 16, Mich.

Ziegler ROLLER DRIVE FLOATING HOLDER for Taps and Reamers...

At Left: Sheffield Precisionaire Gaging Machine simultaneously checking 32 points of inspection.

This is one of a series of applications pointing out the many advantages of Vickers Hydraulic Controls.

Below: Vickers Hydraulic Power Unit installed in base of Sheffield Precisionaire Gaging Machine.



COMPLEX MOTIONS

of this AMAZING GAGING MACHINE

MADE SIMPLE BY

VICKERS HYDRAULIC PUMPS AND CONTROLS

Sheffield Precisionaire Gaging Machine simultaneously measures the diameter at four points in each of 8 cylinders in a motor block—32 points in all. Each bore is then stamped with its true diameter for selective assembly. At the rate of 50 blocks or more per hour, the savings made by this machine have been spectacular.

The machine must make a complex series of motions on each block: (1) ram pushes block into position, (2) two rams from behind push block against stop for accurate transverse location, (3) plunger from above engages hole for accurate longitudinal location, (4) gaging plungers come up simultaneously—one for each cylinder, and (5) withdraw gaging plungers and locating plunger, then return ram.

One push button puts motions No. 1, 2 and 3 (above) into automatic operation; another push button actuates motion No. 4 while a third actuates motion No. 5. To get them all into limited space with proper sequential timing by any other means would have been a difficult problem for the designer. But Vickers Hydraulic Equipment simplified the job. Hydraulic pressure is supplied by a Vickers Power Unit which consists of motor, tank, pump and relief valve all in one compact assembly ready to connect to the hydraulic circuit.

The Vickers Application Engineer nearest you can undoubtedly show you highly satisfactory hydraulic solutions to machine control problems similar to your own.

3081

VICKERS Incorporated

Application Engineering Offices: ATLANTA • CHICAGO • CINCINNATI • CLEVELAND • DETROIT
LOS ANGELES • NEWARK • PHILADELPHIA • ROCHESTER • ROCKFORD • SEATTLE • TULSA • WORCESTER

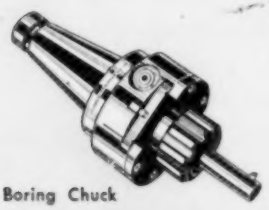
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

FOR PRODUCTION BORING TO .0002" ACCURACY, USE MIKRO-LOK BORING BARS

Finish boring to within .0002" is routine work for Universal Mikro-Lok Boring Bars. The cutting tool is easily and accurately adjusted by means of a micrometer-like dial that is graduated into increments of .0001". This ease of precision tool setting, combined with the anti-backlash arrangement achieved through close-limit assembly of adjusting nut and wedge, means you can speed finish boring and minimize chances for error in machining bore sizes as small as ½". Universal Mikro-Lok Boring Bars are equally efficient for semi-finishing and rough cuts and are especially adaptable to boring to a shoulder or to the bottom of a hole, or for taking intermittent cuts. Minimum number of moving parts insures greater rigidity and longer tool life. Write for complete particulars.

UNIVERSAL TOOLS THAT WILL INCREASE PRODUCTION AND EFFICIENCY IN YOUR PLANT

Index Plunger

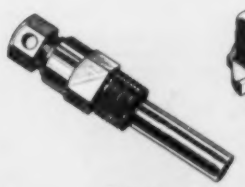

Boring Chuck

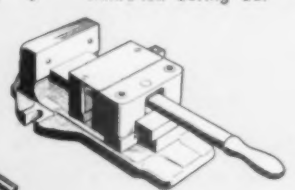
Standard Collet Chuck

Mikro-lok Boring Bar

Floating Chuck

Standard Drill Bushing


Grippit


Wedge-Lock Production Vise

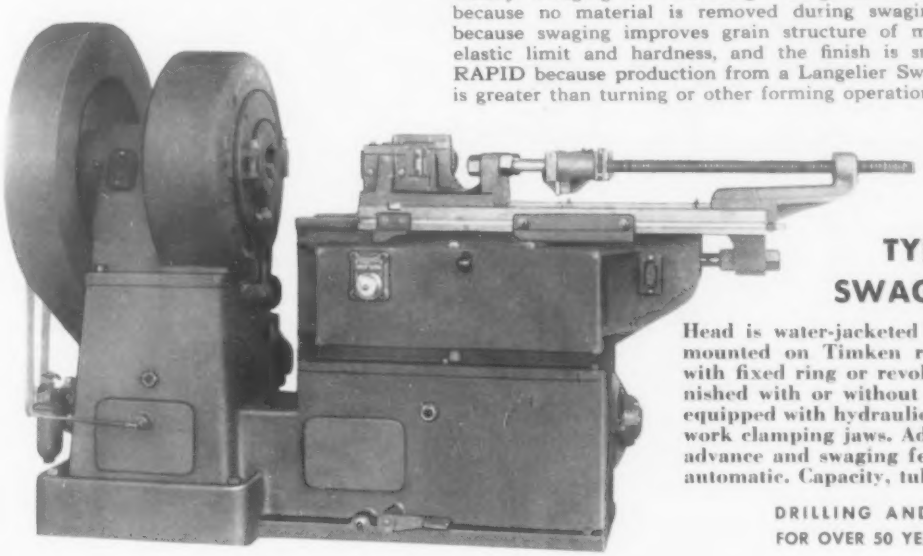
UNIVERSAL ENGINEERING CO.

FRANKENMUTH, MICHIGAN

Designers and Builders of Hot and Cold Swaging Machines, Hammering Machines, Sensitive Drills, Multiple Spindle Drilling and Tapping Machines, Jigs, Fixtures, Tools, etc. Contract Swaging and Machine Work.

LANGELIER SWAGING MACHINES

Rotary Swaging on new-design Langelier Swaging Machines is ECONOMICAL because no material is removed during swaging operation . . . . PRACTICAL because swaging improves grain structure of metal, increases its tensile strength, elastic limit and hardness, and the finish is smooth, to size, and straight . . . . RAPID because production from a Langelier Swaging Machine in almost every case is greater than turning or other forming operations. Timken-mounted spindle reduces power consumption, lengthens life of parts, and provides close concentricity between revolving spindle and circle of head rolls. Investigate!

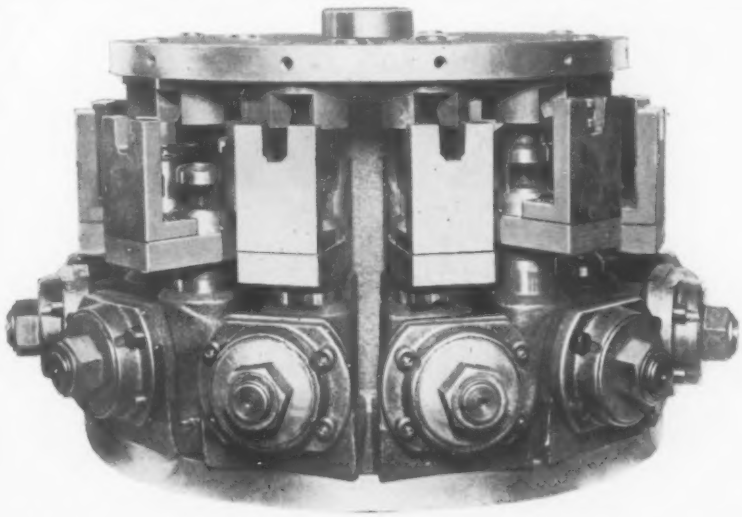


TYPE D and E SWAGING MACHINE

Head is water-jacketed for hot or cold swaging. Spindle mounted on Timken roller bearings. Head construction with fixed ring or revolving cage is optional. Can be furnished with or without holder. Machine as shown here is equipped with hydraulic feeding mechanism and hydraulic work clamping jaws. Adjustable dogs vary length of quick advance and swaging feed to suit requirements. Return is automatic. Capacity, tubing: Type D, 1⅛". Type E, 1½."

DRILLING AND SWAGING SPECIALISTS
FOR OVER 50 YEARS . . . INCORPORATED 1887

LANGELIER MANUFACTURING COMPANY, PROVIDENCE, RHODE ISLAND



Multiple index fixture to locate and drill hole in boss of brake lever.

REDUCE LOADING TIME WITH SWARTZ LOCKS

COMPACT, POSITIVE CLAMPING

MORE PIECES PER HOUR

ALL LOCK PARTS ARE HARDENED AND GROUND

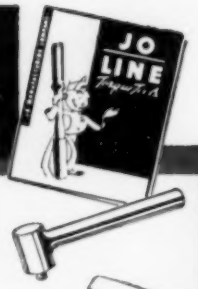
SWARTZ TOOL PRODUCTS CO., INC.

13330 Foley Avenue — Detroit 27, Michigan

Represented by

Cleveland—J. W. Mull, Jr.
Indianapolis—J. W. Mull, Jr.
Milwaukee—Geo. M. Wolff, Inc.
Chicago—Ernie Johnson
Canada—Hi-Speed Tools, Ltd., Galt, Ont.
Houston—Engineering Sales Co.
Los Angeles—Production Tool Engineering
Boston—A. R. Shevlin Co.
Pittsburgh—J. W. Mull, Jr.
Toledo—J. W. Mull, Jr.
Philadelphia, Pa.—Morgan Tool & Equipment Co.

JO LINE All-Purpose Torque Tools*



For Precision { ASSEMBLY / INSPECTION / REPAIR

- Instantly adjustable—or pre-set.
- Automatic tension release without watching, listening, etc.
- Faster action that speeds the job.
- Smaller, lighter, sturdier, tamperproof.
- No external parts to bend or break.
- Torque ranges to 1600 inch/pounds.
- A tool for every production, inspection and service use.

* *Send for new catalog with tables of suggested torque values on general assembly, automotive assembly, etc.*

JO MANUFACTURING COMPANY
South Gate, California

G. I. (Good Intensions) JO says: "Precision tight means it's right".

JO LINE TORQUE WRENCHES

300 TWIN BENDS per hour!

With Two DI-ACRO BENDERS

A difficult production problem of forming two bends in a long length of tubing was solved by "teaming up" two DI-ACRO Benders as illustrated. This dual-forming arrangement saved installation of special machinery. Two accurately formed bends are obtained in one operation—without distortion of the tube and at a cost competitive to power operated equipment. More than 300 pieces are completed per hour—600 individual bends.

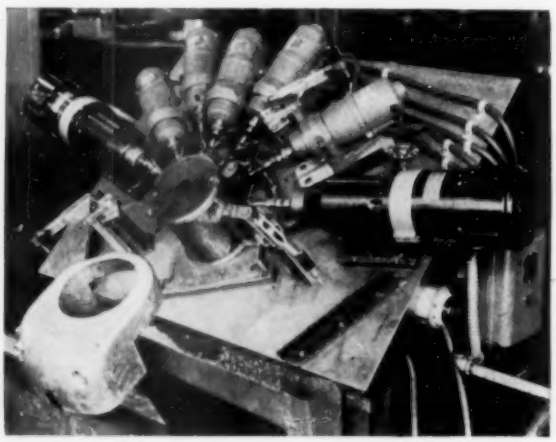
"DIE-LESS DUPLICATING" Often Does It Quicker WITHOUT DIES

This is but one example of how DI-ACRO precision machines—Benders, Brakes and Shears—can accurately and economically duplicate a great variety of parts, pieces and shapes, without die expense. Write for catalog—"DIE-LESS DUPLICATING".

← DI-ACRO is pronounced "DIE-ACK-RO"

DI-ACRO PRECISION MACHINES DIE-LESS DUPLICATING — **O'NEIL-IRWIN MFG. CO.**

375 EIGHTH AVENUE, LAKE CITY, MINNESOTA



A 7-HOLE DRILLING OPERATION SIMPLIFIED

Two Model "K" and 5 Model "C" Govro-Nelson Units on set-up designed and built by Reed Prentice Corp., Worcester, Mass., to drill simultaneously 3-7/32", 2 No. 44, and 2 combination 7/32" drill x 7/16" counterbore holes in die-cast aluminum housings. Drilling time, 2 seconds.

This is an example of how holes of different sizes and at different angles can be drilled simultaneously by the use of Govro-Nelson Units, greatly reducing production costs.

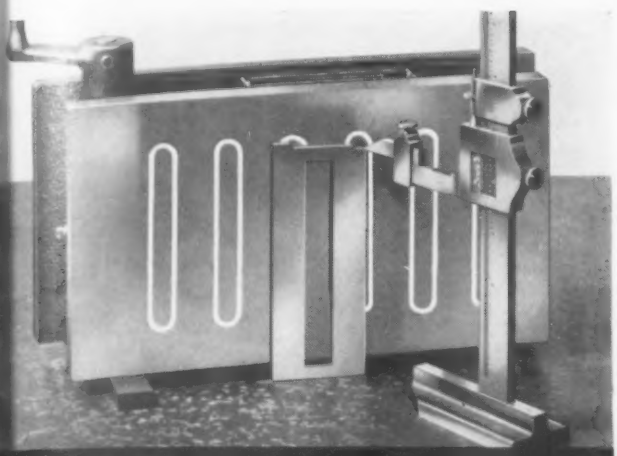
WRITE FOR Literature

Send for literature giving list of prominent users, together with typical applications covering a variety of drilling jobs.

GOVRO-NELSON CO.
1933 Antoinette
DETROIT 8, MICH.

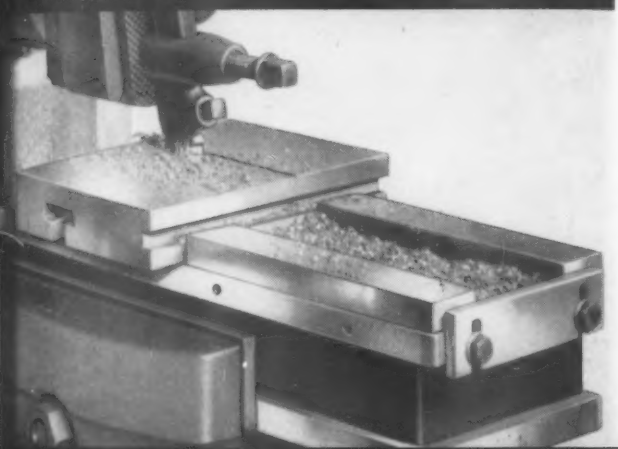
Automatic **DRILLING UNIT**

Set-ups Simplified . . .

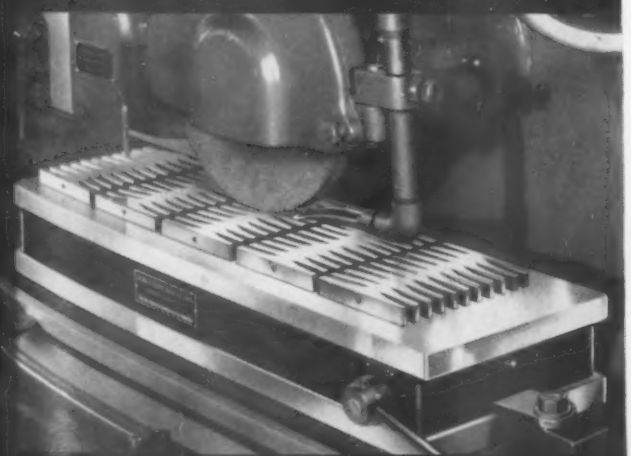


TESTING, INSPECTING and LAYOUT WORK

LARGE SIZES for HEAVY PARTS



LIGHT PLANER or SHAPER CUTS



GRINDING GROUPS of SMALL PARTS

RECTANGULAR MODEL

Permanent

MAGNET CHUCKS

- No wires
- Positive holding
- Instant release

Ready for instant use on any machine of suitable size—no el trical connections needed . . . one chuck can serve one or s eral machines. Also desirable for bench use. Available in fi stock sizes with working surfaces up to 12⅛" x 36".

ROTARY MODEL ALSO AVAILABLE — 9" dia.

Permanent Magnet Chucks are for sale only in the United Sta of America and its Territories. Write for catalog. Brown Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

B·S

We urge buying through the Distributor

BROWN & SHARPE

Fray "ALL-ANGLE" MILLING ATTACHMENT

EASY TO HANDLE
FLEXIBLE
UNIVERSAL • STURDY

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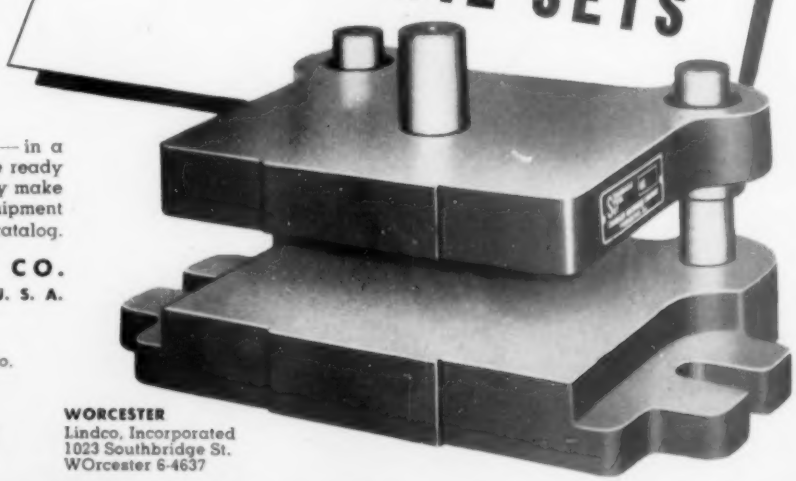

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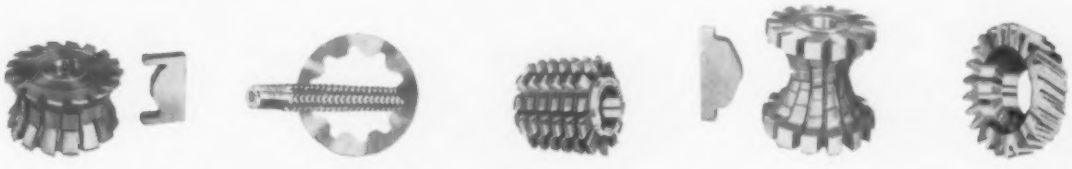

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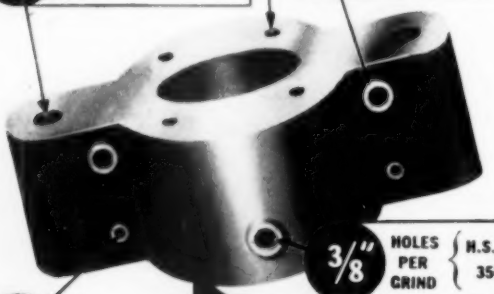

3/8" HOLES PER GRIND { H.S.S. 350 | W-S 31,118

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Records of drill performance kept by a large manufacturer producing cast iron parts, show how W-S Carbide Tipped Twist Drills average 43 times more holes between grinds. Comparisons were made on drilling operations in cast iron. Parts were drilled on multiple-spindle automatic machines. For faster, cleaner lower-cost drilling, try Wendt-Sonis Carbide Tipped Twist Drills in your work. These tools are recommended for drilling plastic and other non-metallic materials as well as non-ferrous metals. Get details in connection with your job requirements.

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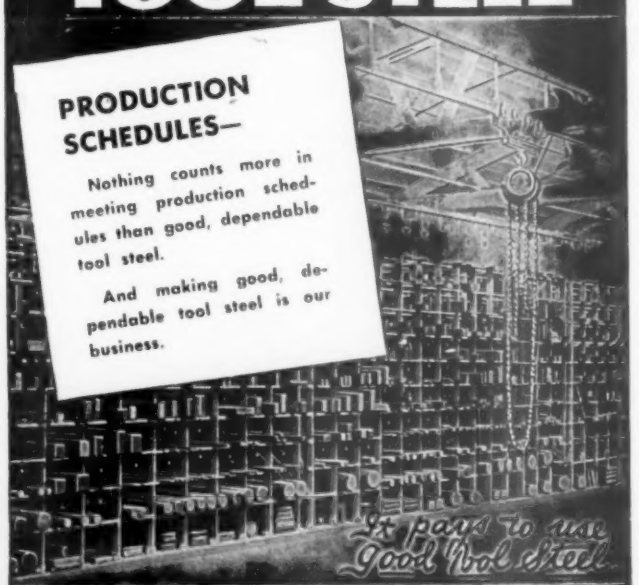
And making good, dependable tool steel is our business.



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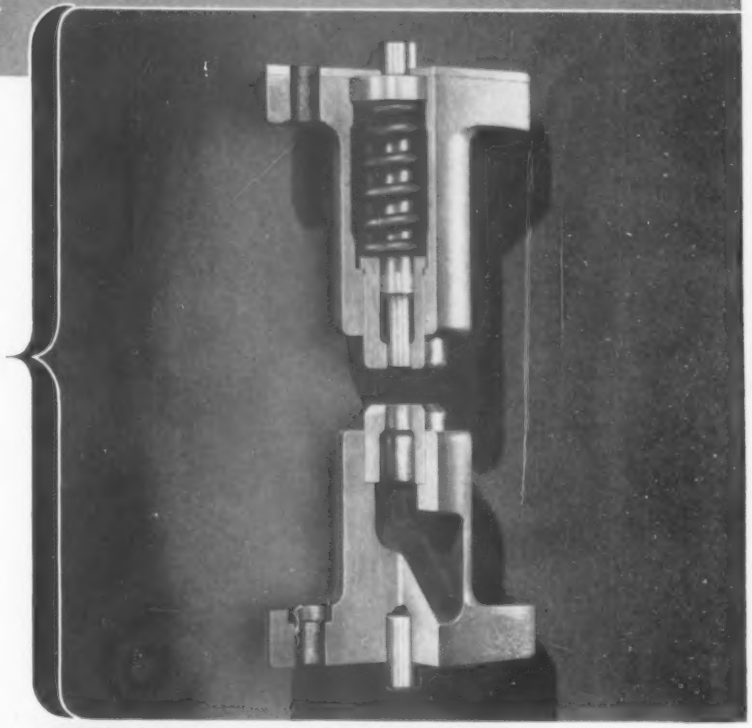
Nothing can be WHAT SHOULD BE SIMPLER FOR HOLE PUNCHING THAN THE WALES PATENTED AND EXCLUSIVE TEMPLATE MOUNTING METHOD*



One Important Application is in Combination with

WALES

Type "CD" Hole Punching Units

Wales Template Mounting Method is the ultimate in simplicity. Various Units are set up on templates outside the press. These template sets are then mounted in a die set which remains in the press. Just insert one pair of templates for each part. Then remove after job is run and insert another pair. Press *"down time" is only a matter of minutes.*

AVAILABLE IN 2 WAYS:

EITHER you make the entire setup with Wales Units and assume all responsibility for proper mounting **OR** complete setup will be made at Wales-Strippit factory backed by a 100% guarantee.

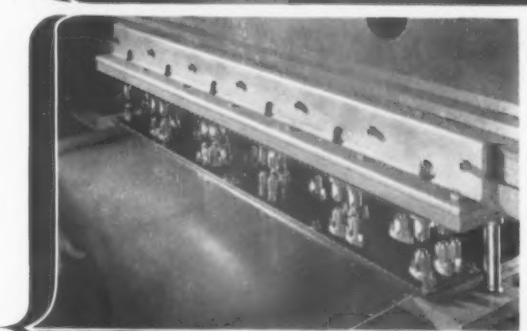
IMPORTANT NOTICE

More and more users are deciding that these punch and die units should not be removed from their mounting plates until the part becomes obsolete. Why waste time and pay money out in unnecessarily moving units from plate to plate when the setup, after once being made, may better remain intact and eliminate the SETUP DRAIN on your operating costs. However, if it is quick rearrangement of standard units you want, nothing can be simpler than using the Wales patented units and mounting methods.

It's too big a story to tell on this page so write for fully illustrated, functionally-colored Catalog CD.

SAME GROUP OF UNITS USED IN STAMPING PRESSES AND PRESS BRAKES

Note: The Wales-Strippit Corporation has not granted permission to anyone to use this patented mounting method *except with Wales Hole Punching and Notching Equipment.



▲ Quarter-section view of Wales Type "CD" Hole Punching Unit showing relationship of parts of the self-contained punch assembly and die assembly.

◀ Scattered, staggered and straight line hole punching patterns may be quickly, easily and economically put into operation with Wales Type "CD" Hole Punching Units. Note Units mounted to templates which are bolted to die set in press brake.

◀ Wales Template Mounting Method permits the next pattern to "stand by" for immediately replacing the operating pattern without removing the die set. Press "down time" is practically eliminated by this interchangeable method.

WALES-STRIPPIT CORPORATION

George F. Wales, President

393 Payne Avenue, North Tonawanda, N. Y.

(Between Buffalo and Niagara Falls)

WALES-STRIPPIT OF CANADA, LTD. • Hamilton, Ontario

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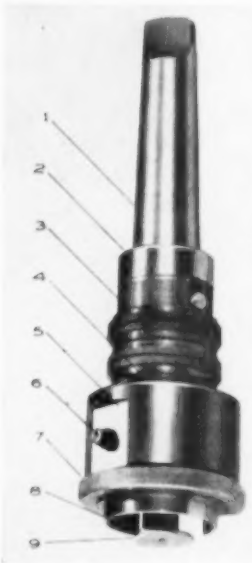
—RECESSING TOOL

for GROOVING, RECESSING, BACK FACING

Adaptable to Drill Press, Boring Mill, Turret Lathe, Automatic, Milling Machine, etc.



1—SHANK—to fit your machine, —threaded to driving sleeve
2—DRIVING SLEEVE—A sliding fit to body shank
3—STOP COLLARS — Adjust to control travel of cutter
4—BODY
5—CUTTER BLOCK—Travels in 1 to 1 ratio and at right angle to sleeve
6—COOLANT HOLE — Permits flow of coolant or lubricant to cutter
7—PILOT RETAINING COLLAR—Holds ball bearing pilot assembly to body
8—PILOT—Made to your specifications, permits rotation of tool or work
9—CUTTER—Made to your specifications for material and work piece.

Cuts one or more grooves any shape or form. Takes cuts at unusually high feeds.

No. 1—Cap. ⅜" to 1" Hole; Std. Shank, No. 3 Morse
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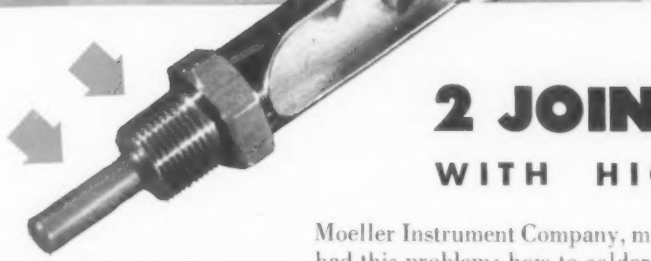
Here's a job that called for 4 operations . . . turning, necking, threading and cutting-off. It was easily handled on a production basis on a lathe with a Colwell turret. No time lost in changing tools, for once the job was set up, changing from one tool to the next, was only a matter of seconds. Colwell turrets are inexpensive, accurate and ruggedly built. Sizes to fit most lathes. Write for catalog.

HOW TO SOLDER POLISHED BRASS

Without discoloration



2 JOINTS IN 5 SECONDS

WITH HIGH-FREQUENCY HEATING

Moeller Instrument Company, manufacturers of precision temperature-indicating devices, had this problem: how to solder two joints of this thermometer case without discoloring the highly polished brass. Solution was found in high-frequency heating, using a Lepel converter which is fully effective on non-ferrous as well as ferrous materials.

Discoloration is completely avoided by concentrating the heat quickly, exactly where needed, and in controlled amounts. Two heating operations are employed: one for the upper joint and one for the lower. With a 15-kw Lepel Converter, as used by the Moeller Company, two cases can be soldered simultaneously. Total heating time for both joints of two cases is 10 seconds — or 5 seconds per case.

A production set-up for this operation is illustrated. With a 30-kw converter, four-position load coils can be used. With pre-formed solder rings and a change-over switch, soldering can be practically continuous — 3500 or more complete cases per day per operator. No skill is required to produce perfect joints, since timing is automatic. Working conditions are clean and cool, ideal for locating on any production line.

SOLDERING
BRAZING
HARDENING
ANNEALING
MELTING

The same Lepel Spark-gap Converter will handle any or all of these processes, usually with advantages similar to those given in this advertisement. Often this unit will prove substantially more economical than any other high-frequency generator—*particularly when heating non-ferrous or non-magnetic materials.* Changing from one job to another can be done in less than 5 minutes.

If you have any operation — on ferrous or non-ferrous materials — which you think might be handled by high-frequency heating, let us make a quick preliminary investigation. If promising, our engineers can run tests, on samples you supply, and report just what can be done. There is no obligation; inquiries are treated with strictest confidence.

A letter to us will bring you, as you prefer, our latest catalog or a call by a representative. Any description of part or process which you can give may enable us to furnish, immediately, specific helpful data. You can help us by mentioning this advertisement.

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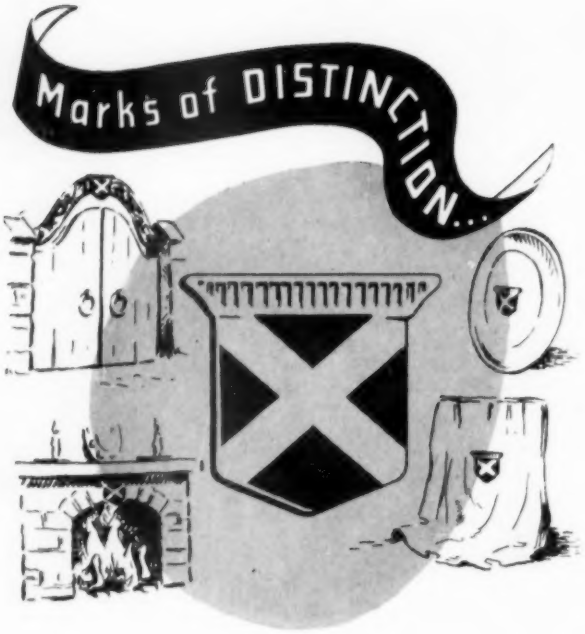

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To set your product apart from others that are similar you need some distinctive marking—trademarks, product names, part numbers—every type of marking for your product to insure your own protection and to eliminate confusion.

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Matthews machines for marking at production speeds are made to answer every need. Included among the processes which are served by these items are stamping, metal embossing, grit blasting, stenciling, rubber die printing and many others. Complete information will be furnished upon request with some indication of your specific needs.

Jas. H. Matthews & Co., for nearly a century the COMPLETE marking house, offers a complete line of marking devices to answer your every marking need. Consult us, giving details and specifications, and we will suggest the marking device to best suit your purposes.

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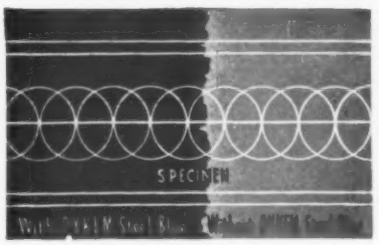

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SQUARENESS • THREAD

WIDTH • AND COMBINATIONS

OF DIMENSIONS

Federal Dial Indicators show where and how much

THE BLIND SPOT
in old-fashioned gaging methods

THE conventional "go — no-go" gage serves only one purpose — it cuts down the passing of defective workpieces. It does nothing to reduce the number of rejects — nor to improve the quality or quantity of output.

Up-to-date gaging methods tell you the what, where and how of your workpieces. You not only cut inspection costs; you also cut production costs and get more production of a better quality.

You gain definitely more by using Federal Dial Indicators because: (1) you instantly *see* your dimensions — you don't feel for them; (2) you actually *see* the amount of the variation. You know exactly *how much* and *which way* each workpiece varies from its specifications.

When used constructively at production as well as at inspection, Federal Dial Indicators tell you much more than the yes and no answers of conventional gages. They tell you when and where production is tending to produce unsatisfactory work so that you can adjust the machine before this happens. And they are, of course, faster, positive and convenient for checking tools and gages and in your laboratory.

Day-in and day-out use demonstrates the durable accuracy of these Dial Indicators. Precisely cut gears, precisely set jewel bearings and parts, plus the *low-friction* of the movement, provide an exceptional sensitivity that enables faithful magnification regardless of the intensity or the degree of the change in dimensions.

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Precision Lathes

There is a degree of accuracy built into the new $1000.00 Sheldon TRB-S56 Precision Lathe heretofore found only in a few of even the most costly lathes. For example, spindle bearings are "Zero Precision," the very finest, closest tolerance tapered roller bearing manufactured. The heavily strutted, 1-piece bed has 2 V-ways and 2-flat ways ground on special bed grinder and held to the closest tolerance of lateral and parallel alignment. The lead screws are milled on the most accurate special lead screw milling machine.

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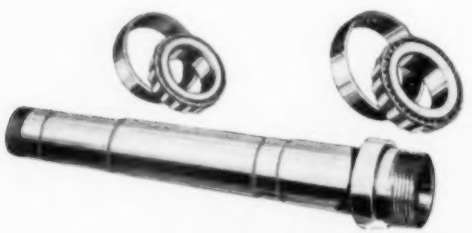

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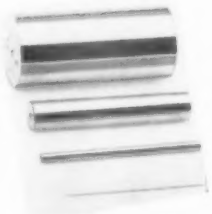
It is easy to use Van Keuren wires. The Van Keuren handbook—"Precision Measuring Tools" gives complete tables and simplified formulas for measuring all standard threads, splines and spur gears. Send for this valuable 144-page handbook No. 33.



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28th YEAR

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Taper Shank Chamfering Cutter with Carbide Tips.

Subland Reamer and Form Relieved Counterbore with Carbide Tips.

Straight Shank Form Relieved Cutter with Carbide Tips.

The perfection of Carbide-Tipped Tools Brazed on Hardened High-Speed Steel Bodies marks an epoch in the creation of tools of higher cutting efficiency. Here are the reasons:

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Then too, the flutes and pilots, because they Rockwell C-62-63 throughout their entire length, do not score or pick-up, the pilot giving much longer wear.

The result is that Carbide-Tipped Cutting Tools with HIGH-SPEED STEEL BODIES give you smoother operation, longer tool life and reduced production costs. You get not only top-quality tools but also top-quality work.

Our engineers will be glad to work with you on your problems.

• MADE TO YOUR SPECIFICATIONS •

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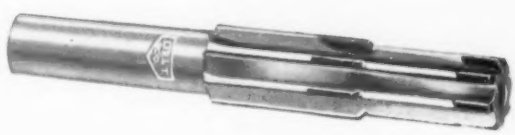
Manufacturers of Oil-Hole Drills, Subland Drills, Special Reamers, Circularity Relieved Reamers, End Mills and Special Tools



Step Reamer with Carbide Tips.

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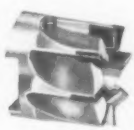
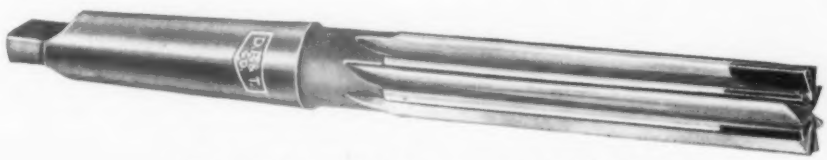
Special Tools To Your Specifications

Spiral Shell End Mill with Carbide Tips.



Straight Flute Shell End Mill with Carbide Tips.

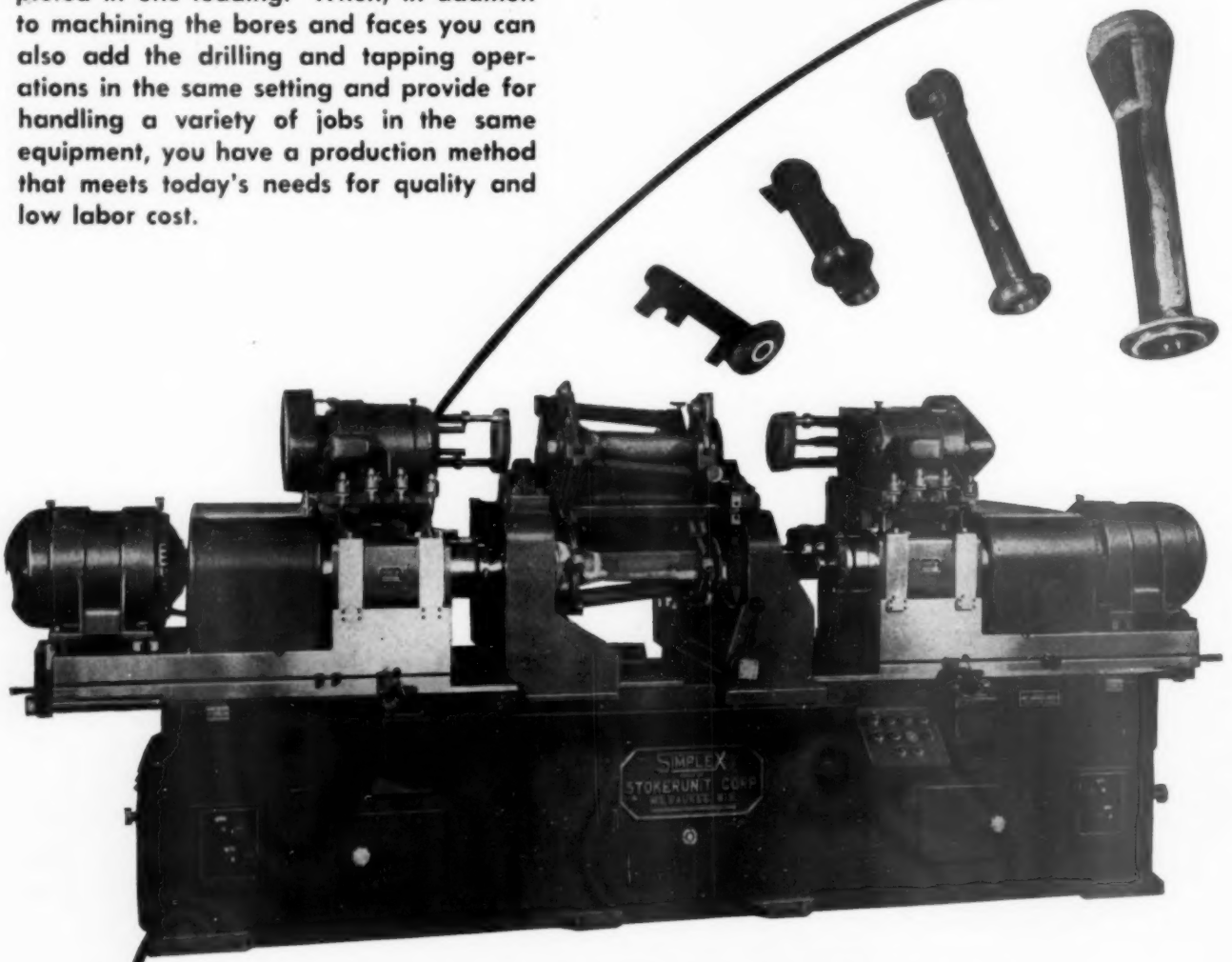
Taper Shank Core Drill with Carbide Tips.



Taper Shank Straight Flute Reamer with Carbide Tips.

SIMPLEX

Machining tubular parts where the bores must be concentric, the faces parallel, is a difficult job unless the work can be completed in one loading. When, in addition to machining the bores and faces you can also add the drilling and tapping operations in the same setting and provide for handling a variety of jobs in the same equipment, you have a production method that meets today's needs for quality and low labor cost.



The machine pictured is a SIMPLEX 4U 2-way Precision Boring Machine with four #4 spindles mounting combination boring and facing heads and also carrying unit type drilling heads with bushing plates for the drilling operation. By changing the fixtures, drills and boring tools, the various pieces illustrated can be handled with the same machine, thus this machine becomes in effect a production department in itself.

Precision Boring Machines

STOKERUNIT CORPORATION

SIMPLEX Machine Tools Division

4528 West Mitchell Street, Milwaukee 14, Wisconsin

Precision Boring Machines, Planer Type Milling Machines and Special Machine Tools

The September issue of the

Tool Engineer

will feature the

1947 National Machine Tool Show

Chicago, September 17 to 26

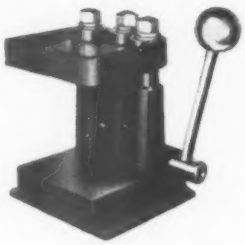
Advertising forms for this Special Show Issue close August 10th. Make your advertising reservation now, write or wire:

Advertising Department

THE TOOL ENGINEER

1922 West Canfield Detroit 8, Mich.

"CONE-LOK" JIGS



The Woodworth "CONE-LOK" jig utilizes the full braking power of its perfectly mated male and female cones.

ACCURACY YOU CAN TRUST

- MECHANICAL SIMPLICITY • ADAPTABILITY
- RUGGED CONSTRUCTION • CHIP PROTECTION
- SEALED LUBRICATION • MAXIMUM SAFETY

★ CATALOG AND FULL SCALE TEMPLATES UPON REQUEST ★

WOODWORTH

N. A. WOODWORTH CO., • SALES DIVISION

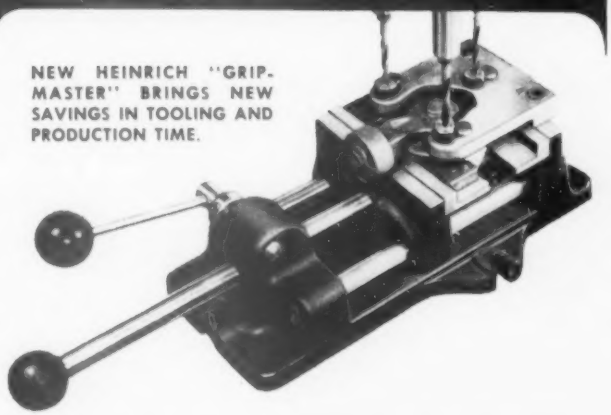
1300 E. NINE MILE ROAD • DETROIT 20, MICHIGAN

USE WORLD'S FASTEST VISE

CUT COSTS UP TO 75%

ON JIGS AND FIXTURES

NEW HEINRICH "GRIP-MASTER" BRINGS NEW SAVINGS IN TOOLING AND PRODUCTION TIME.



You can stop the heavy expense and time losses common in the building of special jigs for drilling and light milling operations. Use the Heinrich "Grip-Master" . . . the World's fastest vise . . . as a base-structure. Built-in bosses and removable parallels permit easy attachment of bushing plates and locating jaws. You can speed up loading and unloading unbelievably, thanks to the large jaw openings of the "Grip-Master" and its revolutionary *screwless* feature.

WRITE FOR FULL FACTS

Ask your Mill Supply Dealer about the Heinrich "Grip-Master." If he does not have a stock, write for folder that illustrates and describes the money-saving uses of this amazing tool.

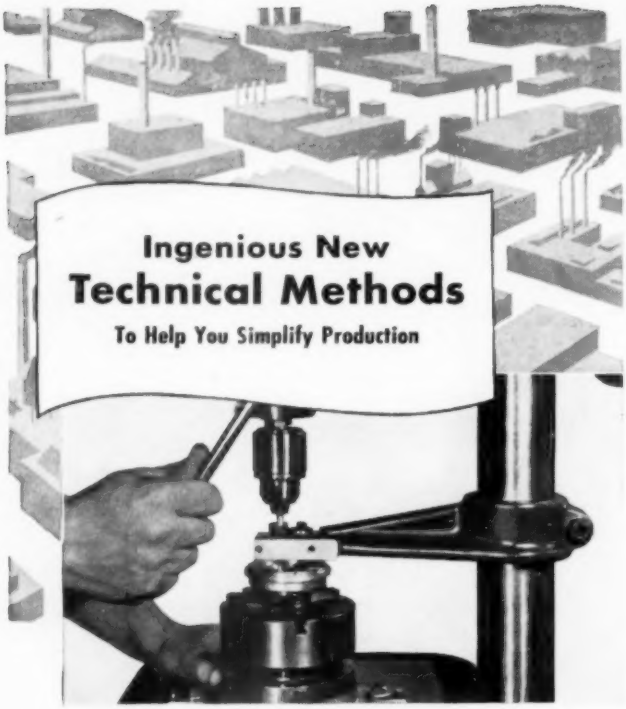
HEINRICH

Grip-Master

DRILL PRESS TYPE SCREWLESS VISE

NATIONAL MACHINE TOOL CO.

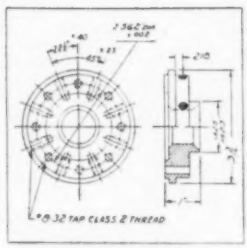
DEPT. 187-D RACINE, WISCONSIN



Precision Adapter for Drill Presses Perfects Alignment—Prevents Drift!

The new Aetna Adapter, of aluminum alloy, fits the columns of most small drill presses—assures accurate milling and deep hole drilling—without a drill jig. It firmly and accurately holds interchangeable drill bushings close to work.

Precision alignment is accomplished through an eccentric aligning bushing, which once set needs no further adjustment. Filler bushings cover the entire bushing range up to ½". Stops to locate the piece to be drilled, are attached to the press table or directly to the adapter. Milling chatter is avoided. Chip interference is eliminated. Overlapping holes can be drilled without punch marks, or indication of run-out, with drills as small as 1/32" diameter. ¼" holes can be drilled more than 6" deep with as little as .006" drift.

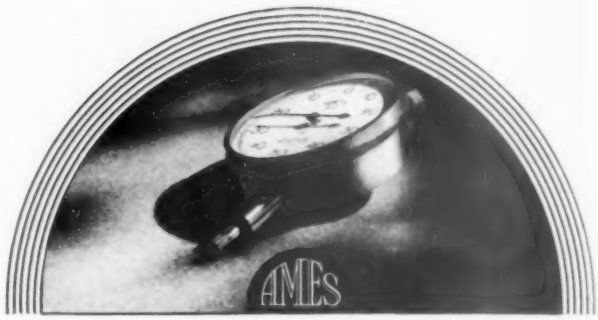


Example of piece drilled with Aetna Adapter

Accuracy in work is achieved best by alert workers. That's why many plant owners make chewing gum available to all. The chewing action helps relieve monotony—helps keep workers alert, aiding them to do a better job with more ease and safety. And they can chew Wrigley's Spearmint Gum right on the job—even when hands are busy.

You can get complete information from
Aetna Mfg. Co.,
250 Chicago Ave., Oak Park, Ill.

AB-60

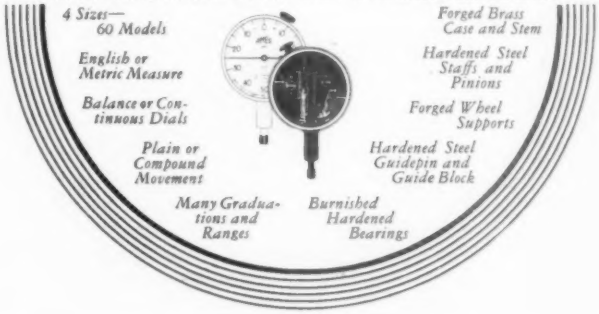


THE *ON-THE-JOB* INDICATOR

Because every part and assembly is designed and built for *lasting protection* of initial sensitivity and accuracy, AMES Dial Indicators give more *on-the-job* time—require fewer adjustments—set a higher standard for speed and economy in checking procedure. For assistance in solving your measuring problems, a complete engineering service is available—without obligation.

Representatives in principal cities **B. C. AMES CO.** *30 Ames Street Waltham 54, Mass.*

MANUFACTURER OF MICROMETER DIAL GAUGES AND MICROMETER DIAL INDICATORS



A tool steel with an original basic formula of our own specifications. Recognized for long die life and unsurpassed quantity production runs.

Outstanding characteristics are simplicity of treatment, uniform hardness penetration to the center, secondary hardness, extremely high tensile strength, resistance to abrasion. Ideal for blanking, drawing, forming, trimming and shearing tools.

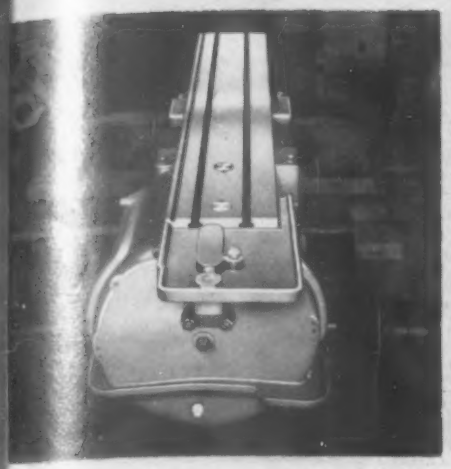
FURNISHED IN BAR STOCK, BILLET, FORGING, CASTING AND WELDING ROD.
BULLETIN ON REQUEST

Representatives in New York City, Plainville, Philadelphia, Pittsburgh, Detroit, Orlando, Chicago, Indianapolis, Milwaukee, St. Louis and Los Angeles.

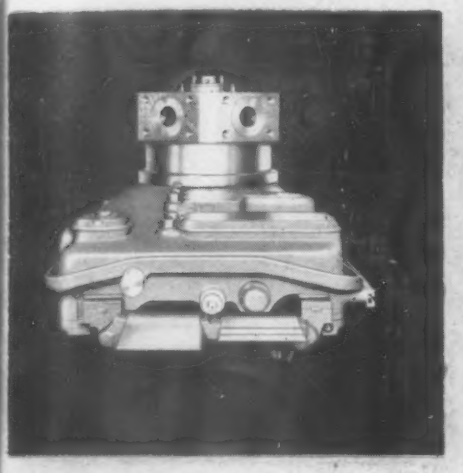
DARWIN & MILNER Inc.

highest grade tool steels

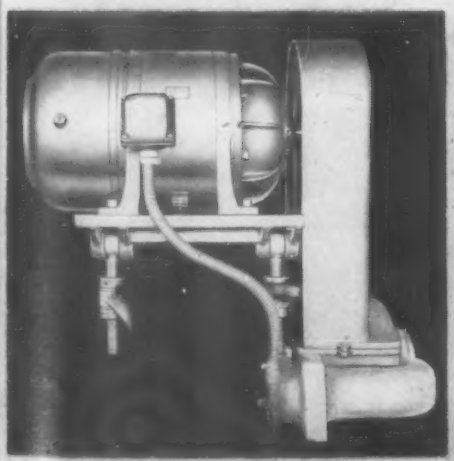
1260 W. FOURTH ST. **CLEVELAND 13, OHIO**



Cross Slide Unit and base are of modern design. The cross slide cam drum is located under the cross slide and the ball bearing cam roll studs are mounted in the cross slide, thus furnishing a direct connection. The cam drum is carried in a compartment at the rear, outside baseways and is readily accessible for application of special cams.



Turret Slide and Unit are of liberal proportions. Turret Slide is provided with hardened and ground steel inserts to form its bearings on base ways, which are also of hardened and ground steel. Turret is automatically clamped in position after indexing. Five turret faces are provided for mounting of tools.

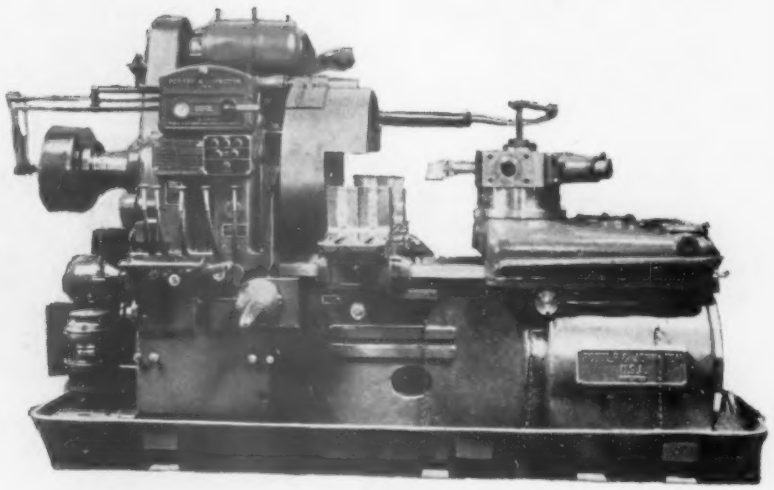


Motor Drive is provided through a special multiple V-belt. A constant speed motor is mounted at rear of headstock and is equipped with a constant speed driving pulley. Another constant speed motor for driving fast motion mechanism is provided and is reversible for setting-up purposes.

P&J

6-D RE, REL & RELX

AUTOMATICS



. . . *with time-proved features that cut production costs*

These P&J Automatic Chucking and Turning Machines . . . the product of more than forty years specialized experience . . . can be depended on to put the production of large duplicate parts in quantity on a low cost, profitable basis. The features described here are typical of P&J leadership in the design and construction of automatic chucking equipment.

Ask for Bulletin 118 giving further details on the 6DREL P&J Automatics. Call on P&J engineers for advice and assistance on your problem of duplicate parts production.

Authorized Agent, U. S. War Assets Corporation

POTTER & JOHNSTON MACHINE CO.

Pawtucket, R. I.

Make an Extra Effort and Buy those Extra Victory Bonds Now!

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Combine Operations

AND CUT PRODUCTION COSTS

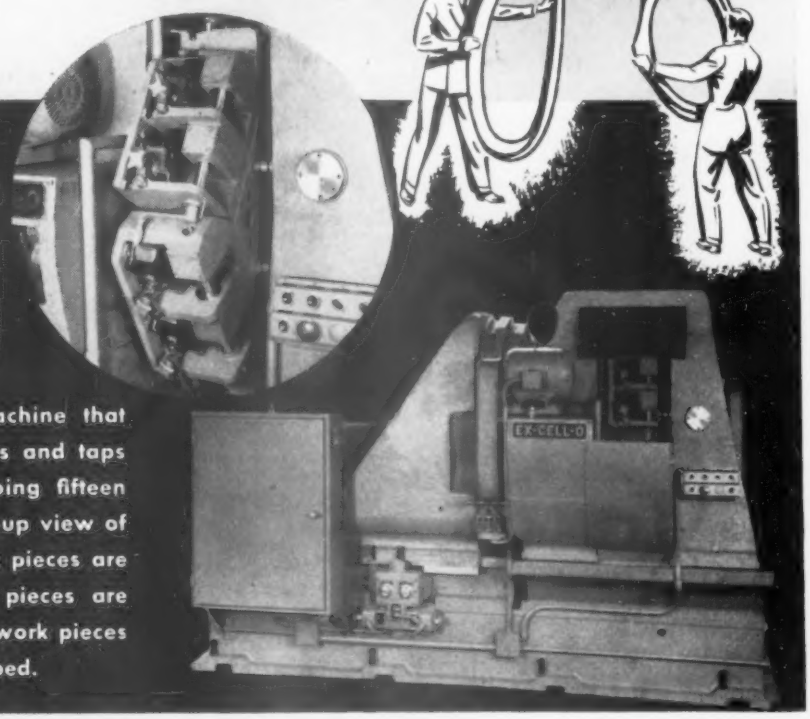
Consider an Ex-Cell-O Special-Purpose Machine; It May Prove a Profitable Investment for You!

In many instances, despite high labor costs, production costs can be held down by combining operations and letting automatic machines do more of the work. Combining operations requires less man-hours, less floor space, less handling of parts, and also assures accurate work . . . as the parts are located and clamped only once the different operations are easily held in correct dimensional relationship. Many industries are combining diversified machining operations on Ex-Cell-O Special-Purpose Machines and finding that it pays off in more parts per hour and lower unit cost.

XLO
EX-CELL-O for PRECISION

47-22

Machine tools are the extension of a man's ability to produce more . . . with less effort . . . and with greater personal gain!



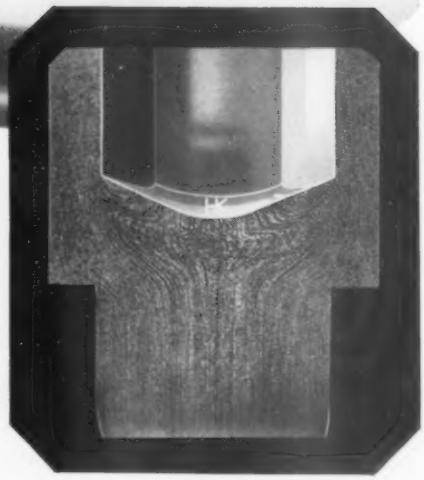
To right: Ex-Cell-O Special-Purpose Machine that drills, countersinks, reams, counterbores and taps malleable iron steering gear parts, doing fifteen operations on each part. *In circle:* Close-up view of fixture with guards removed. Two work pieces are clamped at each station. New work pieces are loaded in the upper front station while work pieces at the lower front are being tapped.

EX-CELL-O CORPORATION

DETROIT 6
MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CONTINENTAL CUTTING TOOLS • MISCELLANEOUS PRODUCTION PARTS
FUEL INJECTION EQUIPMENT • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • DAIRY EQUIPMENT

HOLO-KROME
fibro forged SOCKET SCREWS



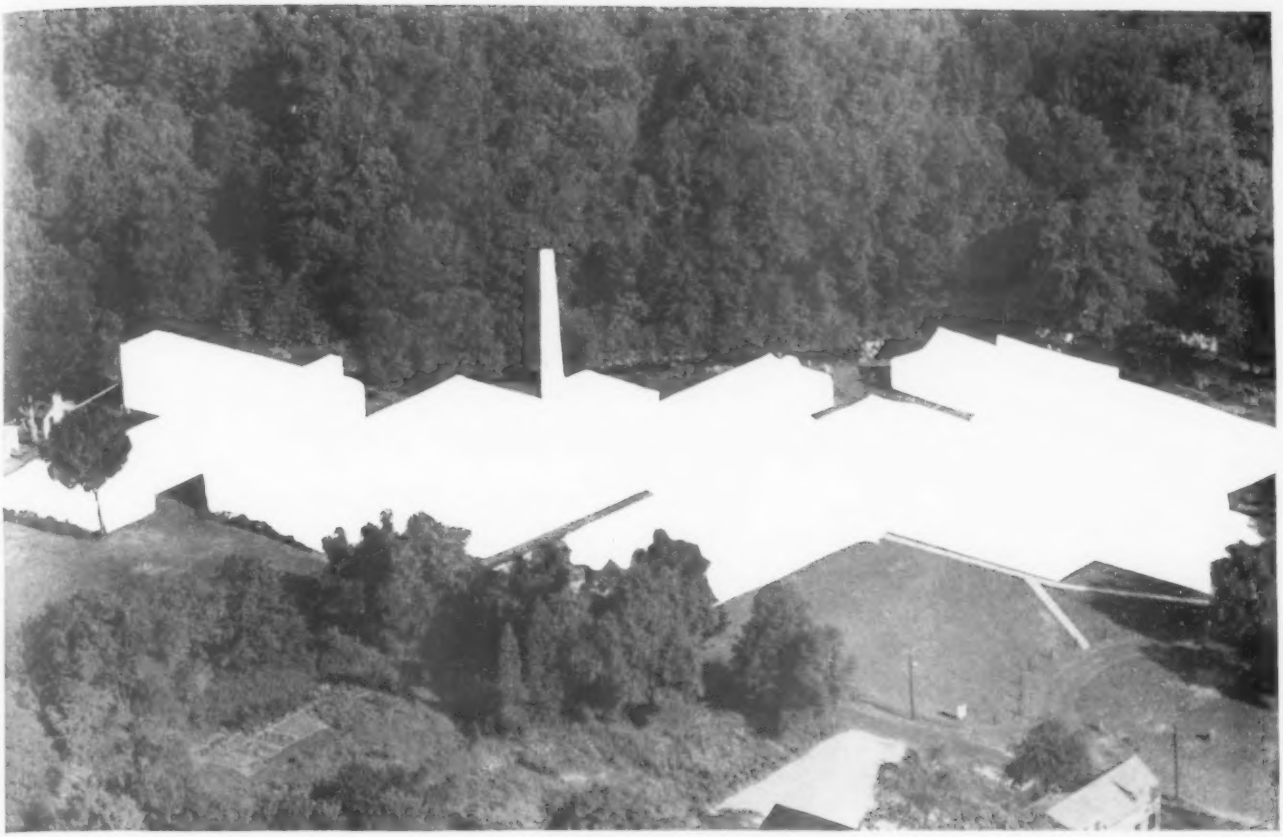
Unretouched Photo Etched Cutaway Holo-Krome Socket Head Cap Screw.

. . . . . ***Alert to the necessity of***

DEPENDABLE PERFORMANCE

in Socket Screw fastenings an ever increasing number of manufacturers are using Holo-Krome Completely Cold Forged Socket Screws because they can depend upon the Guaranteed Unfailing Performance of every single Holo-Krome Product . . . Specify "Holo-Krome."

THE HOLO-KROME SCREW CORPORATION, HARTFORD 10, CONNECTICUT

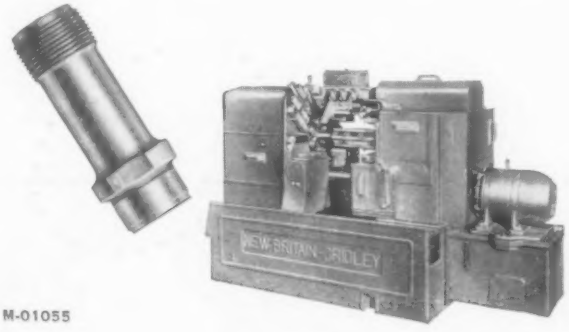


THE PLANT NOBODY HAS EVER SEEN

INDUSTRIAL engineers, labor leaders, management men agree that there never yet has been a manufacturing plant in America that has achieved its absolute maximum of production. Suppose one did exist in which management provided every possible facility, employees used them to the utmost, and management in turn regularly devoted a substantial share of the plant's earnings to invest in more and more efficient machines and methods. Certainly high wages and good returns on stock owners' investments would be no problem to such a business.

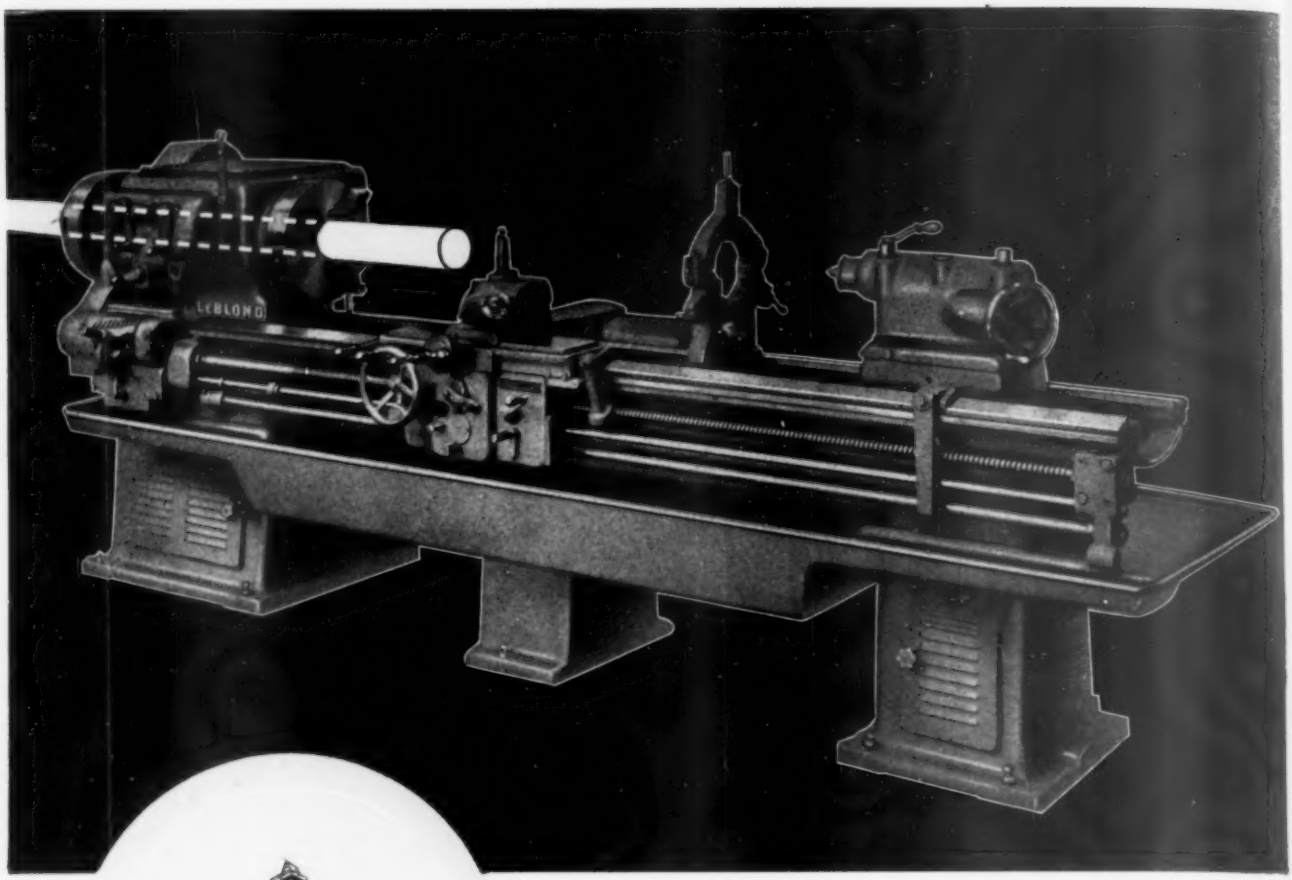
Perhaps the absolute ideal plant will never exist, but the tools exist *right now* to enable almost any manufacturer and his employees to achieve spectacular improvements for their mutual welfare. Such an opportunity lies in management's providing the finest, modern production machinery and the latest production methods. In employees' using such machines for all they are worth. Read below how one manufacturer is taking advantage of this opportunity.

EXAMPLE: The aircraft part shown below, is typical of swift, economical, accurate automatic screw machine performance. Speed is maintained by breaking down the inside boring and reaming into four operations. A total of eleven tools work on this piece which is threaded and cut off in the last position, and close limits of concentricity must be maintained between threads and bore. Regular day by day production: 312 pieces per hour.



M-01055

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT



Got a big hole in our head

...A 5¼" HOLE TO BE EXACT

OIL COUNTRY LATHE FEATURES

- Quiet, powerful headstock with 12 geared speed changes.
- Automatic lubrication system in headstock.
- Flame hardened steel bed ways, front and rear.
- One-piece apron with positive jaw feed clutch. One-shot lubrication.
- Apron controlled reverse to spindle thru powerful multiple disc clutch built into headstock.

LeBlond's 16" and 18" Hollow Spindle Lathes for casting and oil drilling equipment. For any other metal turning requiring a large opening through the spindle. Simple operation with precision results. Now fitted with flame hardened steel bed ways. Also available in 27" and 30" sizes.

THE R. K. LEBLOND MACHINE TOOL CO., CINCINNATI 8, OHIO

LARGEST MANUFACTURER OF A COMPLETE LINE OF LATHES

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Get your copy

of illustrated bulletin describing all four sizes of LeBlond Hollow Spindle Lathes. Write Dept. HS-74

LEBLOND

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